15 Cents APRIL 1907 $1.00 a Year

PUBLIC LIBRARY OF THE CITY OF DETROIT

THE FOUNDRY

THE PENTON PUBLISHING COMPANY.

Cleveland New York Chicago Pittsburg
Boston Philadelphia Cincinnati Duluth

A much Greater Success than we anticipated.

Peerless Dry Core Compound

Cheaper than Flour. Better than Rosin.
More Economical than Oils.

Be convinced by ordering a trial barrel; if not entirely satisfactory, won't cost you one cent.

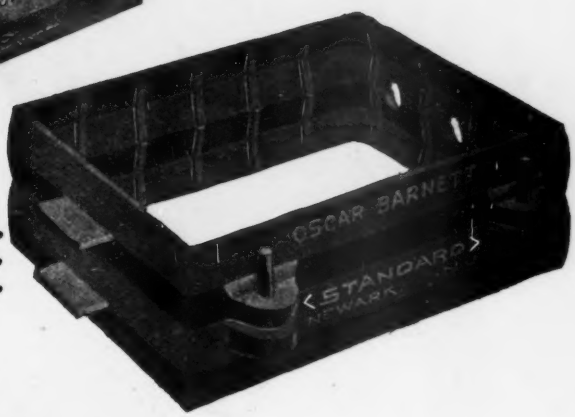
The S. Obermayer Co.

CINCINNATI CHICAGO PITTSBURG

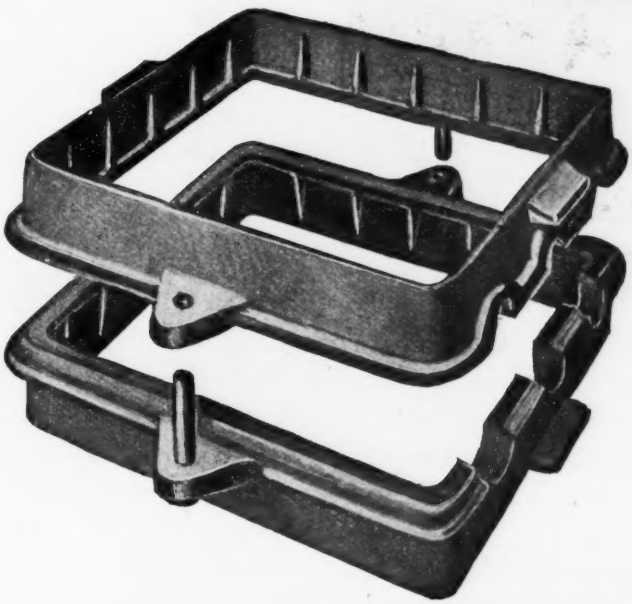
"EVERYTHING YOU NEED IN YOUR FOUNDRY."

Brass Molders' Flasks

Of Every Style and Size



Furnaces, Drying Stoves, Spill Troughs, Clamps, Boards, Tongs, Crucibles, etc., etc.



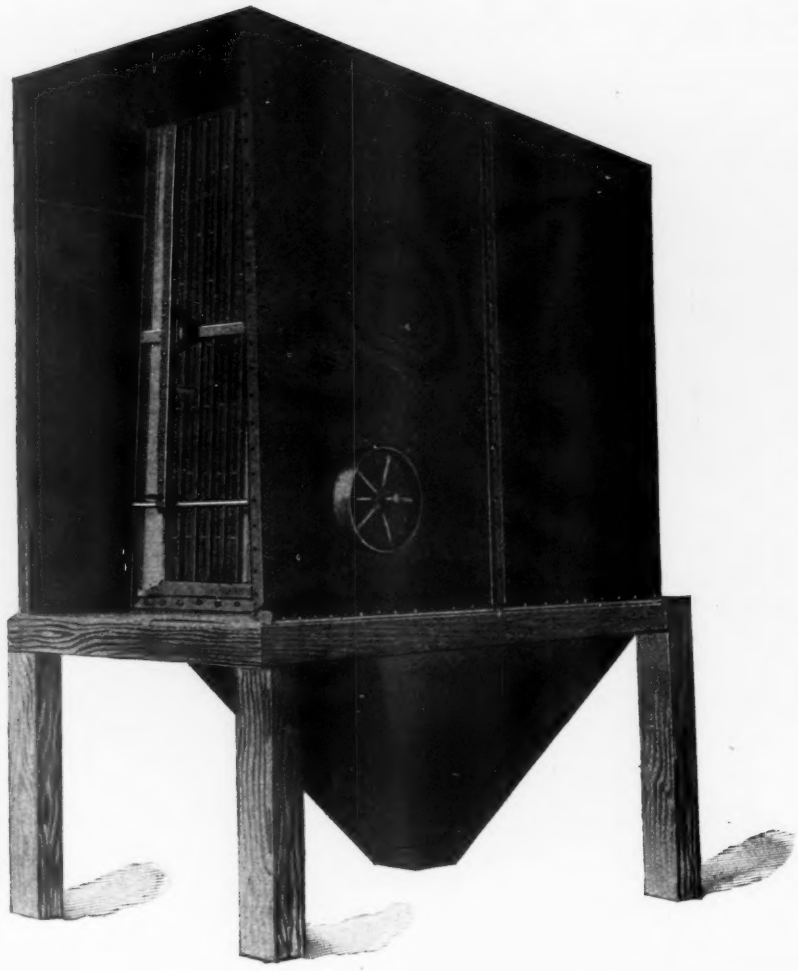
All our flasks interchange with any of same size made by us.

Our own foundries ensure prompt shipments.

THE OSCAR BARNETT <STANDARD> FLASK IS MADE ONLY BY

Oscar Barnett Foundry Co.

Founded 1845 **NEWARK, N. J., U.S.A.**



Steel Case Dust Arrester

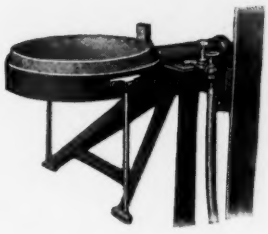
We can take all the dust from your mill room coming from your cleaning mills, and return the air anywhere in your shop perfectly clean. No dust passes through the fan to cut out the blades. You can save the price of this Arrester in one year, taking into consideration the life of the Fan, wear and tear on machinery, and goods spoiled by dust.

Write us, and tell us your troubles. We manufacture a full line of Cleaning Room machinery, and if your cleaning room is not up-to-date, you are losing 100% on it every year.

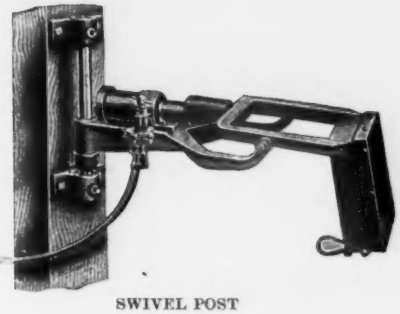
THE W. W. SLY MFG. CO.

Office and Works: Cor. Train and Junction Sts.,
CLEVELAND, O.

HANNA SHAKERS



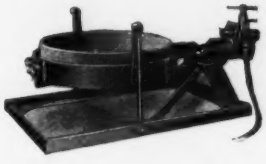
STATIONARY POST



SWIVEL POST

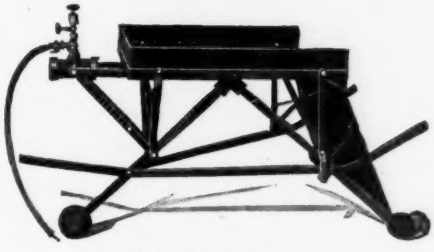
SEE US AT THE FOUNDRYMEN'S CONVENTION

USED EVERYWHERE



GIVE GREAT SATISFACTION

WE WILL HAVE SOMETHING NEW AND INTERESTING TO SHOW YOU



LARGE SHAKER

SMALL TRIPOD

Hanna Engineering Works

820 Elston Ave., CHICAGO.

Thos. W. Pangborn Co., 227 Fulton St., New York City.
Pneumatic Engineering Appliances Co. Ltd., Palace Chambers, Westminister, London, Eng. S. Obermayer Co., Chicago, Cincinnati.

SPRING COMING!

Navigation is Open

Your Bins are Empty

YOU WANT

SAND AND GRAVEL

Lumberton, Albany, Susquehanna and Silica Sands.

Millville and Jersey Gravels.

Each the CREAM of its respective district.
Direct from our banks to you, by boat or rail.

LOWEST COSTS QUICKEST DELIVERIES

Take it up with us right away.

PETTINOS BROTHERS

FOUNDRY SUPPLIES, FACINGS, ETC.

BETHLEHEM, PA.

NEW YORK PHILADELPHIA

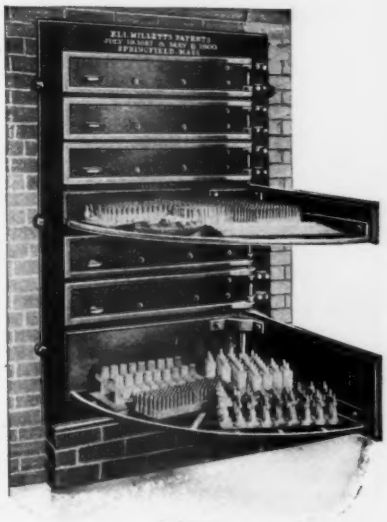
You may get along,

but you'll get along better with the Millett Core Oven in your shop.

The most satisfactory oven built—

Experience of Foundrymen the world over.

To profit by experience is to save money.



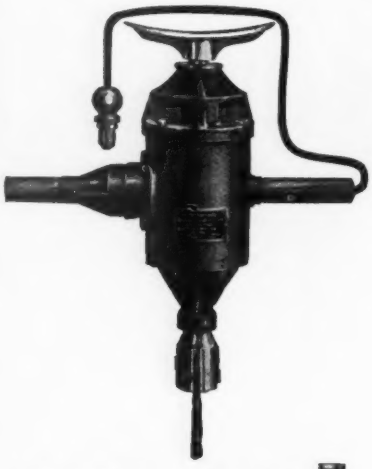
Millett Stationary Core Oven

Millett Portable Core Oven

THE MILLETT Core Oven Co.

Brightwood, Mass., U. S. A.

SALES AGENTS: S. Obermayer Co., Cincinnati and Chicago. J. W. Paxson Co., Philadelphia. J. W. Jackman & Co., London. J. S. McCormick Co., Pittsburg, Pa. Thomas W. Pangborn Co., 227 Fulton St., New York City.



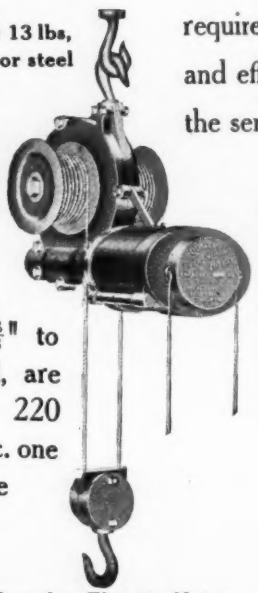
Breast Drill, weight 13 lbs, Capacity ⅝" in iron or steel

DUNTLEY ELECTRIC TOOLS

Are especially adapted to Foundry requirements. They are strong, durable and efficient and guaranteed to perform the service for which designed.

Our Hoists are extremely steady in operation and will be found a valuable addition to your equipment. Capacities 250, 500, 1,000 & 2,000 lbs.

Duntley Electric Drills range in capacities from ⅜" to 3" in iron or steel, are wound for 110, 220 and 550 Volts d.c. one two and three phase a. c.



Duntley Electric Hoist.

Chicago Pneumatic Tool Company

CHICAGO—NEW YORK

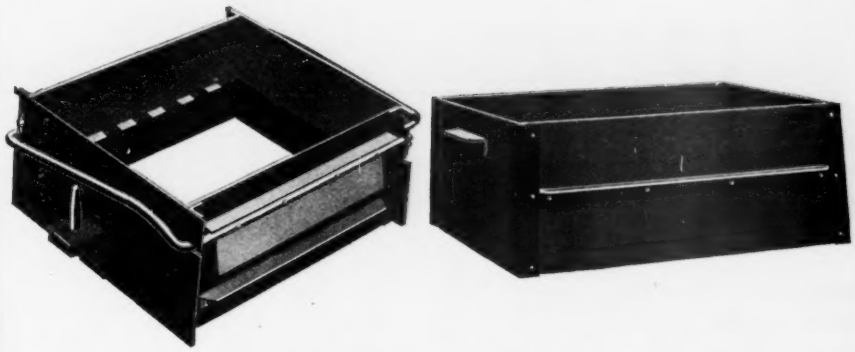
Foreign representative, The Consolidated Pneumatic Tool Company, 9 Bridge Street, London.

Manufacturers Air Compressors, Pneumatic Tools, Hoists, Electric Drills, Etc.

Duntley Portable Electric Grinders are made in sizes and styles to meet all requirements.

DO YOU HAVE 'EM,

RUN-OUTS
BURNING JACKETS
BURNING BOTTOM BOARDS?



THE MACPHAIL STEEL FLASK

Patented Jan. 29, 1907.

Successfully overcomes these difficulties by reason of their peculiar construction. A perfect match between cope and drag, non-adjustable pins and steel jackets make

RUN-OUTS IMPOSSIBLE

Hence no burning jackets or bottom boards.

THE STEEL JACKETS TAKE THE PLACE OF EXPENSIVE IRON FLASKS

Malleable Iron, Gray Iron, Steel and Brass Foundrymen, ask us, we'll tell you.

Macphail Flask & Machine Company

1270 Monon Building, Chicago, U. S. A.

If You'll Just Tell Me

What more I can say than in all these years I have said to get you from UNDER THE ELEVATOR CURSE, I will not only say it, but I'll sing and I'll whistle it.

A fellow gets pretty near written out after ten or twelve years. If our machine was not such a wonderful one we could not have lasted this long.

Now what can I say to-day? Shall I print the great list of users? Shall I again tell you it is fool proof, and all the other great features?

You wouldn't believe it, anyhow.

And I don't blame your skepticism.

A man has to see this wonderful elevator to appreciate it, and not suspicion exaggeration when we tell about it.

All that with only a little steam pipe to the boiler!

The other day a party came here to see our cranes and elevators. All he said was:

"Gee whiz!"

And we get the order for cranes and elevators.

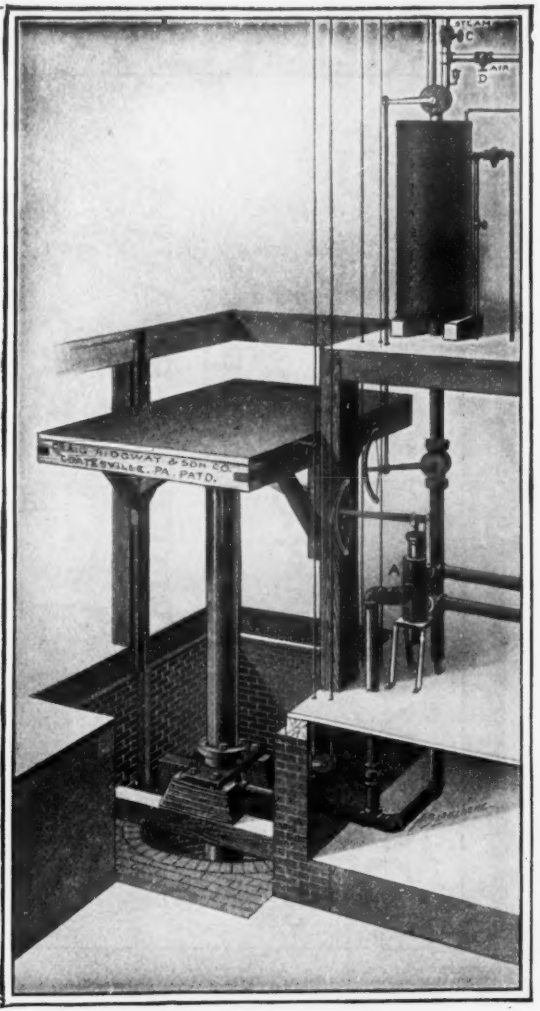
Hook'er to the Biler

and get from

Under the Elevator Curse

CRAIG RIDGWAY & SON CO.

Coatesville, Pa.



THE WADSWORTH

IMPROVED

Core Machines for every need

Hand, Belt, Air, Steam or Electric Driven.
Round cores from 3/8" to 7"
Also irregular shapes.

A—6″ Core, 24″ long, by hand power in 12 seconds.
A—7″ Core, 5′ 3″ long, by hand power in 80 seconds.
How long does it take you to make such cores?

The wide range of shapes, the great strength and accuracy of cores made on our machines make them the best possible investment for your foundry.

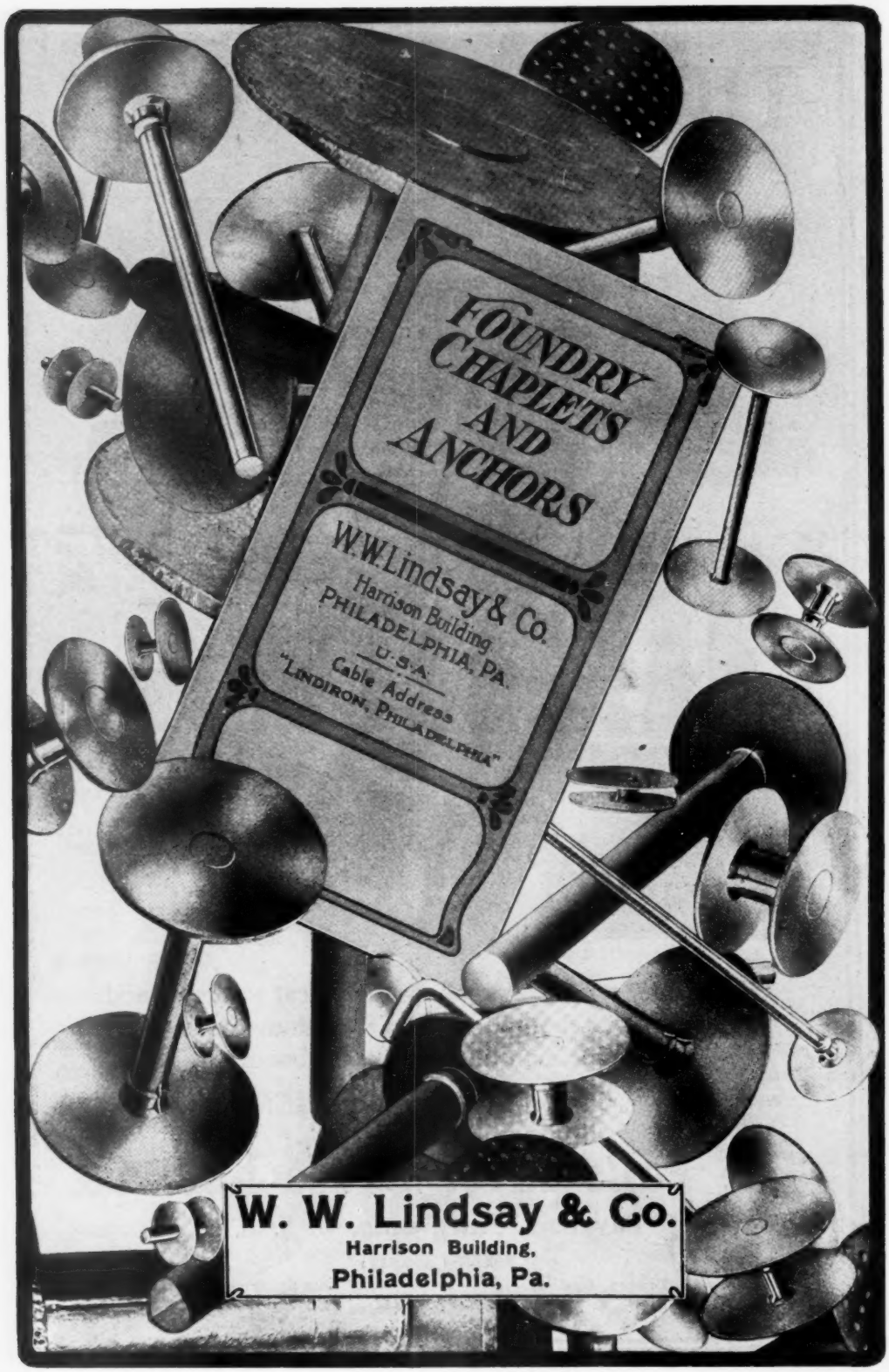
Write for prices and descriptive catalogue.

The Falls Rivet & Machine Co.

Cuyahoga Falls, Ohio, U. S. A.

FOREIGN AGENTS:

J. W. Jackman, London, England. **Frantz Kustner, Dresden, Germany.**
The Hamilton Facing Mill Co., Ltd., Hamilton, Ont., and Montreal, Que.


FOUNDRY CHAPLETS AND ANCHORS
W.W.Lindsay & Co.
Harrison Building
PHILADELPHIA, PA.
U.S.A.
Cable Address
"LINDIRON, PHILADELPHIA"
W. W. Lindsay & Co.
Harrison Building,
Philadelphia, Pa.

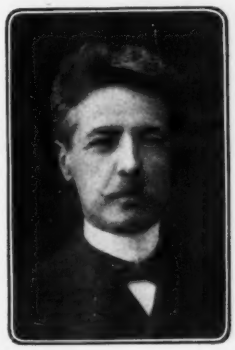
THE FOUNDRY

Vol. 30, No. 2. *CLEVELAND, OHIO, APRIL, 1907.* *Whole No. 176*

METALLOGRAPHY APPLIED TO FOUNDRY WORK--VII

The Microstructure of Cast Iron—Effect of Increasing the Proportion of Combined Carbon

By Albert Sauveur



THE structure of cast iron containing a very small amount of combined carbon was described and illustrated in the last installment of this series. It was shown to consist of a matrix having the same constitution as a low carbon steel and of many graphite particles. Such cast iron may be considered as a very gray iron or what is known as No. 1 foundry iron.

If we now increase the proportion of combined carbon in the iron, its structure assumes the appearance illustrated in Fig. 1, in which is represented a cast iron containing about 0.2 per cent combined carbon. It will be seen that the metallic matrix contains now a larger proportion of the dark areas, which have been shown to consist of pearlite, and a correspondingly smaller proportion of the light constituent or ferrite. Many plates of graphite are still seen to thoroughly break up the continuity of the metallic matrix. The introduction of an additional amount of combined carbon has resulted, therefore, in increasing the amount of pearlite and in decreasing correspondingly the proportion of ferrite. Such results might have been anticipated, for an increase of combined carbon

Fig. 1.—Gray Cast Iron—Combined Carbon About 0.20 Per Cent.

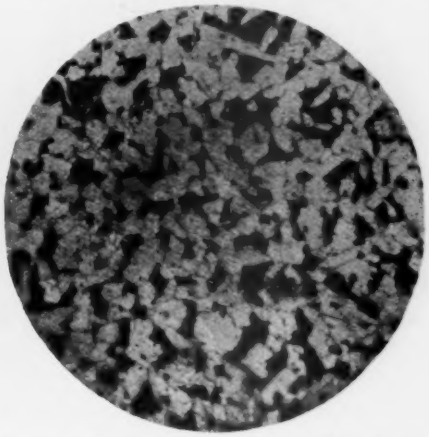


Fig. 2.—Steel—Carbon, 0.32 Per Cent. Magnified 100 Diameters.

means an additional amount of Fe_3C (Cementite) and this Fe_3C will combine mechanically with some ferrite to form an additional amount of pearlite.

Structure of Steel, 0.3 per cent Carbon.

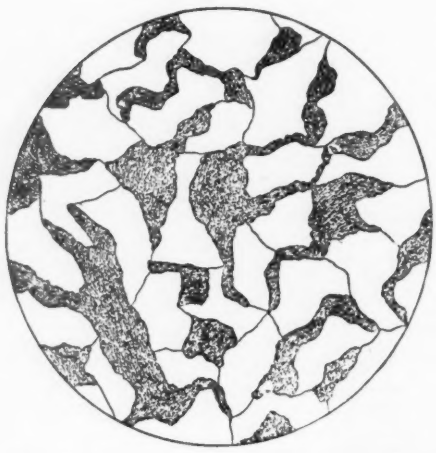


FIG. 3.—STEEL—CARBON, 0.38 PER CENT. (DRAWING BY ARNOLD.)

In Figs. 2 and 3 is shown the structure of steel containing some 0.3 per cent carbon. It resembles closely the structure of the metallic matrix of cast iron containing about 0.3 per cent carbon. Like the latter it consists of pearlite and

FIG. 4.—GRAY CAST IRON—COMBINED CARBON ABOUT 0.40 PER CENT. MAGNIFIED 100 DIAMETERS.

ferrite, roughly in the proportion of one to two. As in the case of the cast iron matrix an increased amount of carbon in the steel has resulted in a correspondingly greater proportion of pearlite and smaller amount of ferrite. Cast iron, containing some 0.2 to 0.3 per cent combined carbon and corresponding probably to a No. 2 foundry, may rightly be considered, therefore, as having a matrix of the nature of a steel containing some 0.3 per cent carbon, but whose continuity is so broken up by many plates of graphite as to have its ductility and strength much reduced. The matrix of this cast iron, however, being stronger than that of a No. 1 foundry iron, it must follow that the cast iron itself will be stronger. It is apparent that a further increase in the combined carbon of cast iron, and of

FIG. 5.—STEEL—CARBON, 0.59 PER CENT. (DRAWING BY ARNOLD.)

the carbon in steel, must result in a further increase of pearlite in the constitution of both metals.

In Fig. 4 is shown the structure of cast iron containing about 0.4 per cent carbon and in Figs. 5 and 6 the structure of steel with some 0.5 per cent carbon. Such cast iron would probably correspond to a No. 3 foundry. It has a matrix resembling a steel of 0.5 per cent carbon. If we bear in mind that the strength of steel increases with its carbon content up to about 1 per cent, it will be evident that the strength of this cast iron must be greater than the tenacity of a No. 1 or a No. 2 foundry iron, that is, of grayer iron. The greater strength of the metallic matrix of the iron must result

in a correspondingly greater strength of the cast iron itself. If we assume moreover, that the total carbon remains the same, it is evident that a larger amount of combined carbon means a correspondingly smaller percentage of graphite, and since every plate of graphite is a source of weakness, we see in this an additional reason for the greater strength of cast iron richer in combined carbon. It is stronger for two reasons: (1) because it has a stronger metallic matrix, resembling a higher carbon steel and, (2) because it generally contains a smaller number of weakening graphite plates.

Increase of Pearlite.

Seeing that the percentage of pearlite

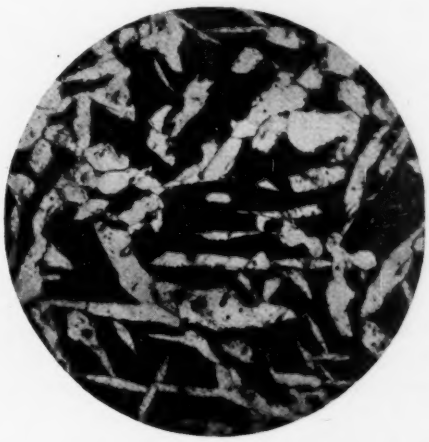


FIG. 6.—STEEL—CARBON, 0.54 PER CENT. MAGNIFIED 100 DIAMETERS.

in the matrix of cast iron and in steel increases correspondingly with an increase in the combined carbon, it is evident that a point must be reached when all ferrite will disappear from both metals, which then will be made up exclusively of pearlite, Figs. 7 and 8. Such critical point in the structure will be attained when the steel contains about 0.8 per cent carbon and the cast iron about 0.7 per cent, (which would mean about 0.8 per cent carbon in the metallic matrix). It follows from this that pearlite contains about 0.8 per cent carbon. Steel made up exclusively of pearlite is frequently called "saturated," "eutectic," or, as recently proposed by Professor Howe, "eutectoid" steel. With a lower carbon content the steel is said to be undersaturated or hypo-eutectoid, and with a larger carbon content super-saturated or hyper-eutectoid.

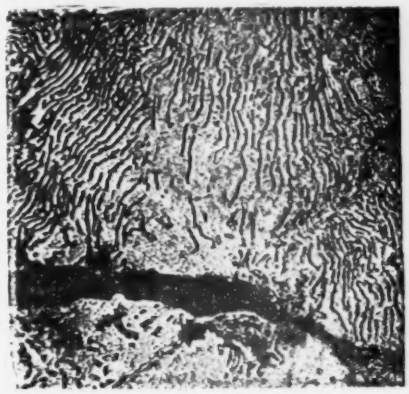


FIG. 7.—GRAY CAST IRON—COMBINED CARBON, ESTIMATED, 0.70 PER CENT. MAGNIFIED 660 DIAMETERS. (LECHATELIER.)

Cast Iron 0.7 and 0.8 Per Cent Combined Carbon.

Cast iron with some 0.7 per cent combined carbon consists, therefore, of a saturated or eutectoid steel matrix and of a generally smaller number of graphite

FIG. 8.—STEEL—CARBON, 0.94 PER CENT. MAGNIFIED 1,000 DIAMETERS. (BOYNTON.)

plates. Such cast iron might correspond to a No. 4 foundry, or possibly to a forge grade. It approaches mottled iron. Bear-

ing in mind that with some 0.8 per cent carbon the maximum tenacity of steel is nearly reached, it must follow that cast iron with a saturated matrix must also be near its maximum strength, and that this will be especially so if the amount of total carbon is small, since this in turn must mean a smaller number of weakening plates of graphite

The structure of cast iron with supersaturated matrix will be described in our next instalment.

ELECTRIC SMELTING.

On the subject of "Electric Smelting for the Foundry," Dr. Richard Moldenke, Watchung, N. J., writes as follows in the *Electrochemical and Metallurgical Industry*:

For some time past foundrymen have been interested in the developments of electric smelting so far as it might be applied to their industry. As the necessary information as to whether iron may be melted in a commercial way can only be given by our electrical friends, perhaps a few remarks on the requirements involved may be of use to those who have apparatus and processes adapted for foundry work.

The average foundryman of today has constant calls for steel castings along with his regular routine work in gray iron. This, on account of the rapid introduction of the steel casting into machine construction. These steel castings he must sub-let to the steel foundries. The latter are looking for tonnage, and do not like to fill up with small quantities of comparatively light work. Hence high prices, which cut the foundryman's profit. In a similar way the foundryman has to deal with malleable castings. The malleable castings founder has both steel and gray iron put up to him, and it may not lie very far in the future when the steel founder may be asked to produce both gray iron and steel castings along with his steel. It is to be understood, of course, that this is all brought about in making contracts with concerns who place their work by the year, or the thousand tons, be the castings what they may during the period of contract.

Now, very few foundrymen are equipped for this. They strive to place these outside lines with other people at the smallest loss to themselves. Yet if there were a convenient and easily oprated process, many of them would install it immediately to take care of just such conditions.

The smelting, or rather plain melting, of iron electrically has always seemed to me ideal in its way. We do not want to produce chemical changes in our mixtures if we can help it. We want only to melt quick, produce very hot iron, and punish the metal as little as we can. Every time we melt the metal under present conditions we hurt it somewhat, the degree of the damage done depending upon a number of conditions, both chemical and physical. We counteract this by additions of steel to reduce the total carbon, or selecting the silicon content in such a way that with the reduction in this element incident to the process, a strong iron results. If, however, we could have a process which in no way changes the composition, we could put into the melt just what we want out of it, and one of the serious difficulties of foundry metallurgy would be solved. Again, if we could regulate the temperature in such a way that the iron is not overheated while melting, but can be heated up very high afterwards, we could obviate the oxidation of the metal during the melt, and in addition remove any existing evil of that kind by the use of ferro-manganese in the melt when it has been brought to practically a steel temperature, at which point the ferro-manganese will do its work.

The induction furnace, it seems to me, fills these requirements, and I would like to see more work done along this line for the foundry. I may be in error, but it would seem to me that scrap of all kinds, properly selected, is all that need be melted, cleaned by some ferro-alloy, and then cast in the usual way. The enormous steel production will always yield scrap enough to supply the demand for small steel castings, once a process of this kind can be made to work commercially, and I would be very glad to be of assistance in bringing a process of

this kind to the attention of the foundry world.

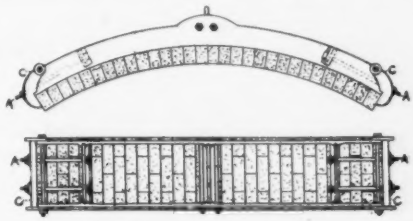
Taking the non-ferrous metals. A brass foundry would have abundant use for an electric smelting process, if run on the lines laid out above. The melting loss in the brass foundry in zinc and tin is a great one, and one that runs up into money quickly. A clean, wasteless process, as the electrical one should be, would be a boon to the industry. There are many foundries which could melt within short periods of time during the day or night when their plant is not used for its regular purposes. Hence only the electrical apparatus proper might be required, the necessary power being available.

The foundry has practically every melting process under the sun in use for making the various classes of castings. We see the open-hearth, the Bessemer and the cupola, the air furnace and the crucible in operation everywhere. Yet every metallurgist knows that the crucible process gives the best metal, if you can stand the cost. Now, the electrical furnace, if the melting proper is conducted so that the advantages of the crucible process are retained; that is, the temperature not allowed to exceed safe limits, and the metal kept from oxidizing influences, is bound to give the highest class of product, and it seems to me with the greatest ease of manipulation.

I would therefore urge the study of the line of work in contradistinction to the smelting of steel from ore; in other words, to simply melt, instead of completing the cycle of operations in a metallurgic process. The great foundry industry is ready to take this up once the commercial feasibility has been demonstrated.

MALLEABLE FURNACE BUNG.

The malleable furnace bung illustrated herewith, recently patented by H. B. Strate, of the Buhl Malleable Co., Detroit, is designed to keep the brick from falling into the furnace and to hold them until they have done full service or are burned almost through. The body of the bung is constructed of cast iron and the brick are held in place by means of the bolts A, and the pivoted clamps C. In the construction of this device the use of long rods is obviated, thus preventing expansion which permits the brick to become loose when only half used, and it is further claimed that the bung is much more easily constructed. This bung has already been widely used and there have been practically no delays in the heats by the giving way of the



MALLEABLE FURNACE BUNG.

brick, making it necessary to place another bung on the furnace and to skim the fallen brick from the molten metal. The latter feature is an important item as to its efficiency. It is claimed that the saving of brick amounts to 50 per cent and frequently large charging bungs which receive hard usage have been known to last 80 heats.

PROFIT SHARING PLAN.

The Nordberg Mfg. Co., Milwaukee, Wis., has adopted a plan of sharing profits with its employes which will add amounts ranging from $30 to $100 a year to the wages of each of the 600 men employed by the day. Based upon the length of service, the men will receive a percentage over and above their yearly remuneration. Those who have been in the employ of the company seven years or more will receive an additional 8 per cent.; those employed more than three years and less than seven years will receive 7 per cent.; and those employed one year and not more than three years will be paid 6 per cent. The plan does not include men employed on regular salaries.

CASY PROVED IT.

Lady (in party viewing the foundry)—And which is the foreman?

Casy (proudly)—Oi am.

Lady—Really?

Casy—Oi can prove it. (Calls to molder). "Kelly, Kelly; yer foired."—*Judge.*

JOBBING FOUNDRY COST SYSTEM*

Recommended by the Jobbing Founders' Association—Simple and Comprehensive

Standard forms suggested for adoption by job shops

By H. D. Miles.

THE determination of an accurate and adequate distribution of the cost of the products of a manufacturing plant is necessary to its most successful operation. Such a determination affords the means for reducing the waste of labor and material to a minimum, and provides the correct information needed in establishing prices for quotations. The failure to secure this accurate information turns estimating into guess work, and forces the bidder to be guided entirely by his competitors' figures. If competition is keen, and cost keeping lax in any line of trade, demoralization in prices will prevail, even in good times, resulting in numerous liquidations in dull times and an uncomfortable number of them under normal trade conditions. The gray iron foundry trade has been affected, to a certain extent, by the situation just described, the evils being aggravated by machinery manufacturers who enter the jobbing field when their business is slack and take in work to maintain their foundry organizations, or because they seek the profits which they estimate the jobber is making, not knowing the heavy expense the latter is under in providing equipment to care for the constant varying grades of work which the jobbing shops are forced to handle.

While I make this statement with some hesitation, I think that statistics would prove that large and intricate engine and pump castings, even when subjected to government inspection, due to increased competition, now sell for 40 per cent less than they did 10 or 12 years ago, despite the fact that labor has increased in cost and decreased in efficiency, and iron and other supplies which enter into their manufacture have very materially increased in value.

It is not to be inferred from this statement that we have receded from enlight-

ORDER BLANK--PATTERN SHOP

BUFFALO, N. Y. _____ 19____

Make for _____ Customer's Order No. _____

Contract No. _____

Ship to _____

Via _____

QUANTITY	DATE MADE.	
	DESCRIPTION.	

FIG. 1.—ORDER BLANK.

*Paper read before the Pittsburg Foundrymen's Association Pittsburg, March 4.

enment to dense ignorance; on the contrary I believe that some progress in cost keeping has been made, but not nearly what should have been to keep step with the steadily increasing competition.

Recent indications point to an awakening interest in the subject; the sentiment is not strong or insistent, but is apparent enough to give encouragement. Where competition is keen, accurate information must be generally diffused if prices are to be maintained on a profitable basis. In addition to the expense of producing castings, sufficient allowance must be made for defective castings. This applies especially to jobbing shops which have a varying percentage of castings condemned after delivery to customers.

Machinery builders who make their own castings usually determine promptly what castings are defective, and can, therefore, more readily determine the per cent of loss; besides their product does not vary as does the product of the jobber, and their losses are correspondingly reduced.

In determining prices, the percentage to allow for defective castings should vary with the class of castings required, and the method of inspection to which they are to be subjected.

Government inspection being the most unreasonable and rigid, the allowance for losses in government work should be the greatest. My experience teaches that such allowances are not great enough. Some foundrymen do employ adequate cost systems and do make all proper allowances when estimating prices, but there is a sufficiently large number who do not to affect the whole trade and force the intelligent bidder to take work at ruinous prices or else reduce the output of his plant to a point where the per-

DAILY TIME REPORT.—FOUNDRY.

EACH WORKMAN IS REQUIRED TO CAREFULLY FILL OUT ONE OF THESE FORMS EACH DAY, AND HAND IT TO HIS FOREMAN BEFORE LEAVING THE WORKS.

CHECK NO._____ _____190__

TIME OF_____ RATE_____ Per Hour.

ORDER No.	No. Pieces	PATTERN NO.	CLASS OF WORK	No. of Hours	AMOUNT

_____Total Hours. Approved._____ Foreman.

FIG. 2.—DAILY TIME REPORT.

BUFFALO FOUNDRY COMPANY.

DAILY TIME SHEET. BUFFALO, N. Y._____190__

No.	NAME	CON No.	TIME	HOURS	KIND OF WORK	AMOUNT

FIG. 3.—DAILY TIME SHEET, BUFFALO FOUNDRY CO.

BUFFALO FOUNDRY COMPANY.

CUPOLA REPORT. BUFFALO, N. Y. _____ 19...

No. Charge	COKE	LIME	GRADE AND WEIGHT OF IRON							TOTALS	Class of Work
1											
2											
3											
4											
15											
16											
Totals											

Run Out, Gates, & Risers, _____ lbs.

Cupola Bottom, _____ lbs.

Scrap Core Arbors, _____ lbs.

Scrap Loam Plates, _____ lbs.

Defective Castings, _____ lbs.

Signature _____

FIG. 4.—FORM FOR CUPOLA REPORT.

BUFFALO FOUNDRY COMPANY

CASTING REPORT **HEAT** _____ **190**__

NUMBER GOOD	WEIGHT GOOD	NUMBER DEFECTIVE	WEIGHT DEFECTIVE	CONT. No.	DESCRIPTION
					TOTAL,

_____ **CASTING CLEANER**

FIG. 5.—FORM FOR CASTING REPORT.

Buffalo Foundry Co. TIME & COST SHEET.

Contract No. _____ Description _____ Pattern No. _____ Piece No. _____

Customer _____ Order No. _____ Weight of each piece _____ lbs. Commenced _____ 190

Floor No. _____ Month _____ Loam ___ Dry Sand ___ Green Sand ___ Open Sand ___ Cast _____ 190

Sym.	No.	NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Hours	Rate per Hr	AMOUNT

MATERIAL:

Preparatory Work:

	Total No. Hours	Cost		Total No. Hours	Cost
A—Moulder			F—Appr. Core Maker		
B—Handy Moulder			G—Helper		
C—Apprentice Moulder			H—Pit Rammers		
D—Core Maker			I—Chippers		
E—Handy Core Maker					
			Total		

FIG. 6.—TIME AND COST SHEET.

DISTRIBUTION SHEET.

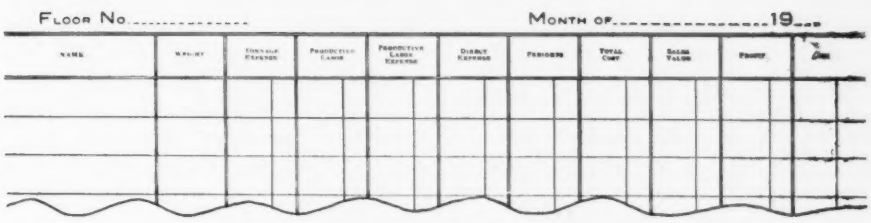


FIG. 7.—DISTRIBUTION COST SHEET.

centage of overhead burdens is increased unduly and a loss results.

Believing that through an organized effort conditions could be improved, about a year ago I wrote the managers of many of the jobbing foundries in the eastern and middle states whose plants were confined to medium and heavy weight gray iron castings, suggesting a meeting for the purpose of discussing foundry costs, and such other topics as might be of mutual interest. Receiving many favorable answers, a meeting was called in March, 1906, which was attended by the representatives of over 20 companies. The discussion which took place demonstrated what was generally believed, that there were a great variety of methods used and if some were right, others must be entirely wrong. As a result of this meeting two committees were appointed; one on organization and the other on costs. The cost committee employed an expert to aid in the formulation of a uniform cost system, which might be generally adopted. The cost committee held several meetings and finally submitted to the association a system as outlined on the blanks which will be referred to later.

The organization committee submitted its report at the last meeting, recommending that a permanent organization be formed to be called the "Jobbing Founders' Association," and this name was adopted.

The report of the cost committee was received and the secretary was instructed to distribute the blank forms to the members to be studied and criticisms submitted to the cost committee. This is where the matter now stands.

The expert employed by the cost committee recommended an elaborate system of costs, going minutely into details, which included a monthly inventory and a system of bookkeeping which included in its scope the cost accounting. The committee feared that so elaborate a system would defeat the ends sought, and, therefore, submitted the simplest form of cost keeping possible and one that can be kept practically independent of the regular accountant's department. This system may be amplified and provided with as many checks and balances as may be deemed advisable, by anyone using it.

The order blank, Fig. 1, is 11 x 8½ inches, and comprises four copies, one for the foundry, one for the pattern shop, a third for the shipping clerk, and the fourth for the invoice clerk. This blank contains a line for the name of the customer, the customer's order contract number, and lines for such shipping instructions as are necessary. A column is left for the designation of the quantity of castings and smaller columns are also provided to denote the dates when the various sections are made. The forms shown by Figs. 2 and 3 are daily time sheets and are respectively 5¼ x 7 inches and 8½ x 11 inches. The first form sheet is to be filled out each day by the molder and to be handed to the foreman before leaving the works. It provides a line for the check number, the name of the molder, and the rate per hour. Columns are also provided for the order number, the number of pieces, pattern numbers, class of work, the number of hours devoted to the same, and the amount. The other time sheet, which is used by the Buffalo Foundry Co., Buffalo, accomplishes practically the same purpose, and the various columns, although differently arranged, provide for practically the same information.

The form for the cupola report, Fig.

4, is 11 x 11 inches, and can be varied in size according to the number of heats made from day to day. The column on the left indicates the number of the charge or heat, and columns are also provided to designate the weight of the coke and lime, and the grades and weights of the iron used in the various heats. Columns are also left for the totals and also for designating the class of work. At the bottom of the sheet, lines are provided for the weight of the run-out, gates and risers and cupola bottom, the weight of the defective castings, scrap core arbors and scrap loam plates.

A casting report, 8½ x 11 inches, which designates the heat number, is shown in Fig. 5, and provides columns for the weights and numbers of the good castings, as well as those which are defective, a contract number of the order and a description of the section. This report is filled out and signed by the casting cleaner. The time and cost sheet, Fig. 6, is likewise 8½ x 11 inches, and provides for more detailed information regarding the cost of making the sections. At the top of this form are entered the contract number, description of the casting, pattern number, number of pieces, name of the customer, order number, weight of each one of the pieces, the date when the work was commenced, the floor number, the month and the method of molding, whether in loam, dry, green or open sand and the day when section was cast. Symbols are used to designate the various workmen such as are shown at

EXPENSE APPORTIONED TO TONNAGE. **Month of.....190**

Iron { PIG, SCRAP, Etc., COKE FOR MELTING, LIME, }	
Cupola Labor, (not including foreman,)	
Cupola Repairs, Material, ...	
Flasks, ...	
Sand, ...	
Facing, ...	
Chaplets, ...	
Yard Labor, ...	
Power for Blowers, ...	
Iron Tonnage ..... Per lb. ..... Total,	

PRODUCTIVE LABOR.

Moulders, ...		
Moulders' Helpers, ...		
Moulders and Helpers on Preparatory Work, ...		
Other Direct Labor, making Pits, Ramming up, etc., ...		
Core Makers, ...		
Chippers and Cleaners, ...		
Total,		

EXPENSES APPORTIONED TO PRODUCTIVE LABOR.

Office Expenses		
Traveling Expenses, ...		
Salaries, Officers, Superintendent and Foreman, ...		
Pattern Labor Applied to Foundry, ...		
General Labor, ...		
General Supplies, ...		
Power, not mentioned above, ...		
Heat and Light, ...		
Interest, (investment included,)		
Taxes		
Insurance, ...		
Other Expenses, not specified, ...		
Productive Labor $ ..... Per cent ..... Total,		

FIG. 8.—FORM FOR SUMMATION OF COSTS.

the bottom of this form, A designating the molder, D the coremaker, G the helper, I the chippers, etc.

At the head of each one of the columns is shown the day of the month, and in this are entered the number of hours devoted to the order. Other columns are also provided for the total number of hours, the rate per hour, and the amount, and the sum total is entered as shown at the bottom of the sheet. To the left, at the bottom of this form is also provided a space for the amount of material used and also a space for the preparatory work required.

Fig. 7 is a distribution cost sheet, 11 x 8½ inches, on which the name and contract number are entered, the weight of the sections, the tonnage expense, the productive labor expense, the direct expense, freights, total cost, sales value, and also columns for the profits or losses on each individual piece of work. The summation of the various expenses is shown in Fig. 8, this form being 8½ x 11 inches in dimensions. Under the head of expenses apportional to tonnage are the following items: Iron, including pig and scrap, coke for melting, and lime; the cupola labor, not including the foreman; cupola repairs, material, etc., flasks, sand, facings, chaplets, yard labor, and power for blowers. A line is left for the iron tonnage and the cost per pound can be readily secured from these two totals.

Under the head of productive labor is entered the expense of molders, molders' helpers, molders and helpers, on preparatory work, other direct labor, including the making of pits, ramming up, etc., coremakers, chippers and cleaners.

The expenses apportioned to productive labor include office and traveling expenses, salaries of officers, superintendent and foreman, foreign labor applied to the foundry, general labor, general supplies, power not heretofore mentioned, heat and light, interest on investment, including taxes, insurance, and other expenses not specified. This form enables the company to readily arrive at the cost of filling each order, as each item of expense in the foundry is entered.

THE CONNELLSVILLE COKE SUPPLY.

Discussing the expectation that the coking coal of the Connellsville and Lower Connellsville regions will be worked out within a quarter of a century, the Connellsville *Courier* says:

The problem of a first grade coke supply for the iron and steel trade would be serious if it were not for the fact that exhaustive tests have demonstrated that there is another big field of coking coal lying adjacent to the Lower Connellsville field, known to the trade as the Green County field. It covers the greater portion of Greene County, and extends westward almost to Wheeling. The same measures extend northward into Washington County for a limited distance and involve a small area of that county. Tests of the Greene County coal show it to be possessed of the same characteristics as the Lower Connellsville coal, the product of which is now generally classed with Connellsville coke. The Greene County field is, in fact, a continuation of the Lower Connellsville field westward. The vein grows larger as it goes westward, averaging 8 to 9 feet in thickness, with a maximum thickness of 11 feet on Dunkard Creek.

It is to the Greene County field that the iron and steel interests of the country are looking for their future supplies of furnace and foundry fuel. The H. C. Frick Coke Co. has already purchased some 3,000 acres in Monongahela and Greene townships, and a company has taken up quite a body of the coal on Muddy Creek, and is preparing to develop it at an early date. Several large concerns are negotiating for imperial acreages with a view to early operations. These negotiations are necessarily with J. V. Thompson, of Uniontown, Pa., who owns the larger coal area of no less than 11 townships of Greene County, which his foresight and courage have accumulated. His coal lies mainly east of Waynesburg, and includes the larger portion of the two townships west of that town. It all lies along or convenient to the proposed Uniontown & Wheeling Short Line. It is the main portion of the field, and occupies largely what may be termed the basin.

MOLDING A DOUBLE FLANGE PULLEY BY MACHINE

Difficult job successsfully accomplished

By C. R. McGohey.

THE scope of the molding machine is a subject that we are all deeply interested in and we feel that there are many new ways and methods when we come to the practical application of the molding machine. Our foundrymen are all busy studying new work for the machine and determining its usefulness on the various classes of work now being done on it.

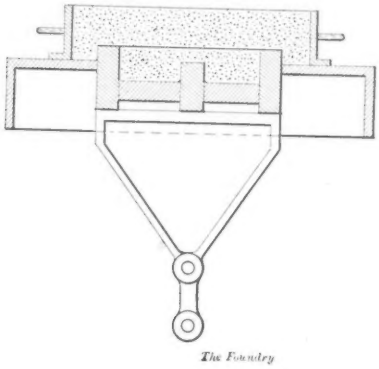


FIG. 1.—PATTERN IN PLACE.

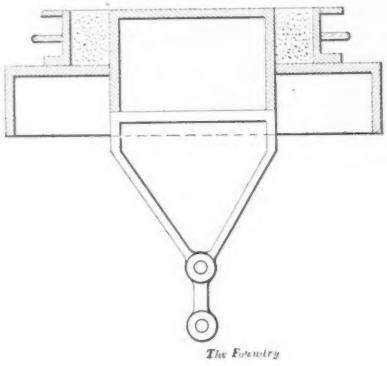


FIG. 3.—CHEEK PATTERN IN PLACE.

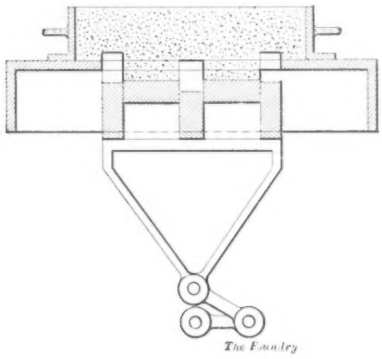


FIG. 2.—PATTERN DRAWN.

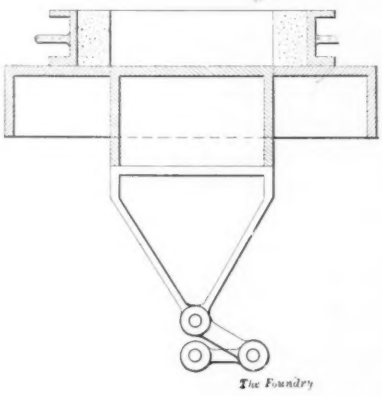


FIG. 4.—CHEEK PATTERN DRAWN.

The writer of this article has had a large and varied foundry experience and has really come up with the machine. In 1887 we put in a molding machine in a big car manufacturing shop. This he principally used for making the oil boxes for cars, and this is not such a simple job for an automatic molding machine as one would suppose. When we speak of an automatic molding machine, we mean a self-ramming one. A great many of our machines simply draw the patterns,

which are very useful, on gearing especially, but the ramming has to be done by hand; yet they facilitate matters very much by getting a better casting which comes nearer to conforming to the pattern. I wish to show how a job that was called difficult on a molding machine was successfully accomplished. On this machine, which was of the Pridmore type, the ramming had to be done by

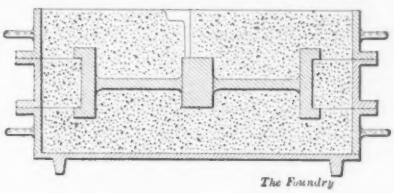


FIG. 5.—THE MOLD.

hand. In this instance the casting wanted was a double flange pulley, shown in Fig. 6, which was wanted in large quantities. The pulley was 12 inches in diameter and had a circumference of about 3 feet.

The first operation is shown in Fig. 1. Here we have our flask on the machine and are ramming up the pulley. In Fig. 2 we rammed the mold and have drawn the pattern. Note that the spoke plate is stationary and that the spokes stick through as shown, bowing down and leaving the sand as indicated. This forms a cope or drag piece, as they are the same. This piece is laid on the floor and on a companion machine the cheek pattern is mounted as shown in Fig. 3. This forms the cheek by ramming and striking it off even. Lowering the machine as shown in Fig. 4, the cheek is ready to be taken from the machine and placed on the floor piece that was made for the drag part.

Returning to machine, Fig. 2, the cope

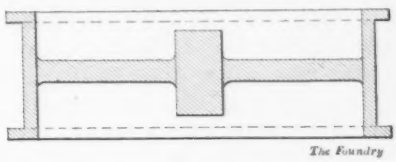


FIG. 6.—SECTION OF PULLEY.

piece is used, which is the same as the drag, except that a gate plug is rammed for the gate. The cope is then removed from the machine and the mold is closed, as shown in Fig. 5, which is illustrated with the casting, for the sake of clearness.

We all know that this is a slow job by hand and it costs a great deal to make these small pulleys. This method makes one pulley in three minutes, including closing. If one molding machine will not make a job, try two, and if two will not make it, try three.

SCIENCE IN THE FOUNDRY*

BY WILLIAM W. HEARNE.

The selection of pig iron, its mixing and melting in the foundry, is becoming a matter of much more interest than formerly. Twenty-five years ago there was not a foundry in the United States that had a chemist in its employ, and scarcely a blast furnace producing foundry iron had a laboratory. Foundry iron was bought, sold and mixed entirely by its appearance, and by the experience the foundryman had previously had with the same brand. At that time this was a comparatively safe and satisfactory method to pursue, for the reason that the ores and fuel from which each furnace made its product were largely drawn from local sources, and the name of the district in which the furnace was located indicated the nature of the iron.

The great growth of the iron industry in recent years and the development of the Lake Superior ore region have changed former conditions. Furnaces in Milwaukee, Chicago, Detroit, Toledo, Cleveland, Buffalo, and the Mahoning and Shenango valleys, southern Ohio, Pittsburg, central New York central and

*Paper read before Section D of the American Association for the Advancement of Science, at the New York meeting, Dec. 28, 1906.

eastern Pennsylvania, can and often do, run on almost the same mixture of ore continuously. There are furnaces in this country, notably in Virginia, that operate exclusively on their own local ores and local fuel. The foundryman fortunate enough to obtain this iron does not need a laboratory, for he generally knows from experience how this iron will work and how much of a certain grade of scrap it will carry to make certain castings. I consider these brands of foundry iron ideal as the furnaces making them are comparatively small, operate with a low blast pressure, and the ore and fuel they use are low in sulphur.

As the chemistry of foundry practice is one of elimination, this has been the cause of almost limitless specifications. Many experiments have been made by men having preconceived ideas of the results to be attained, and the result is, that if castings are satisfactorily made with an iron of a certain analysis, the foundryman insists that this be strictly adhered to, not knowing, for example, that if he had an iron containing silicon, 2 per cent; phosphorus, 1.1 per cent; sulphur, 0.05 per cent; manganese, 1.25 per cent, he would get the same results and possibly a much better and sounder casting than with a brand that analyzed silicon, 2.50 per cent; phosphorus, 0.80 per cent; sulphur, 0.035 per cent, and manganese, 0.440. The phosphorus, if anything, will give the iron more fluidity than the silicon and the manganese is a powerful oxidizing agent. When the iron of the second analysis is melted at least one-third of the manganese is lost, taking with it the sulphur and possibly some picked up from the fuel. This is especially true if the iron is tapped from the cupola into a big mixing ladle, so as to give the manganese time to act.

The cupola is a very poor medium in which to make an iron mixture, as very little reaction occurs beyond the loss of some silicon and the addition of sulphur. Furthermore, the slags of most cupolas are too acid. Manganese is lost which should be carried forward into the mixing ladle, where it could be used to eliminate the sulphur. Not nearly enough lime or fluorspar is used by foundrymen generally. If they would introduce fluorspar to their molten iron, they would be surprised at the amount of sulphur they would remove.

There are three things necessary for a good foundry mixture, namely, fluidity, softness and strength. Fluidity is to be attained, first, by hot metal, and second, by the presence in the pig iron of certain alloys, such as carbon, silicon, phosphorus and manganese, and its freedom from sulphur.

The real softness of a casting depends on the total amount of carbon and on the proportion of the graphitic to the combined. This every foundryman knows and the real problem is how to secure the proper proportions. In pig iron the proportion of free or graphitic carbon to the combined depends entirely on the rate of cooling, and the slightest accidents at the time of casting will affect this proportion and will change iron which should have been 2X foundry to No. 2 plain or No. 3 foundry. In the old days many blast furnace men took advantage of this fact and made their pig molds short and fat, so as to open the grain, so that iron which in silicon and sulphur content would have been No. 2 plain by slow cooling became a 2X foundry. The furnace operator has more to lose than to gain as anything which impedes or interferes with the running of the iron has a tendency to combine the carbon and it is a matter of common practice to have X, 2X, No. 2 plain or No. 3 foundry iron in the same cast, which will vary only in the proportion of the combined and graphitic carbon.

Chief among the foreign elements in pig iron to affect the carbons chemically is silicon. This element has the property of throwing out of solution the carbon in the graphitic form and many melters seem to think it the only cure for all hard iron, and everything else being equal, it is safe to conclude that iron carrying 2.5 silicon is softer than one carrying 2 per cent, but silicon is not a softener in itself and this alone is accomplished by the effect it has on the

carbons. An iron containing 10 per cent silicon can scarcely be drilled. Another containing 4 per cent silicon will not contain as much total carbon as one of 2.50 per cent, as the silicon unites with the iron and robs it of some of its carbon. For this reason a high silicon iron never has the dark, open fracture of one containing only from 2.50 to 3 per cent silicon.

Sulphur is the most dangerous enemy of soft and sound castings, as it not only has a tendency to combine the carbon, but by so doing causes the grain to close up and retain in little holes or sacks gases which should escape causing the casting to pit and become porous.

If iron can be kept fluid a sufficient time the sulphur will all rise and pass off. This can be proved by drilling holes in any pieces of iron of reasonable size poured in open sand. If three holes are drilled, one above the other the proportion of sulphur in each set of drillings will vary with the height. This was demonstrated ten years ago by Guy R. Johnson in a series of 100 experiments. The problem that presents itself is to give the sulphur an opportunity to get away before it is locked in the casting.

There are many ways of accomplishing this, but the easiest and simplest is by using an iron carrying a fair percentage of manganese together with a large mixing ladle. In special cases this can also be done by putting into the mixing ladle a small amount of pulverized ferromanganese, fluorspar or aluminum, as all of these will cause the iron to boil, permitting the sulphur to be thrown off. Being free from sulphur, the casting will necessarily be soft, as it will have the proper proportion of graphitic carbon.

There is a brand of iron made in Virginia from ores mined on the property, smelted with coke mined by the company, which demonstrated the futility of grading pig iron by silicon and sulphur only. A foundryman took an iron made in western Alabama, analyzing as follows: Silicon, 3.25 per cent· phosphorus, 0.90 per cent; sulphur, 0.05 per cent. Another grade from Birmingham analyzing about the same, except that the phosphorus was about 0.75 per cent and a Virginia iron which contained silicon, 1.5 per cent; phosphorus, 1.15 per cent; manganese, 1.00 per cent, and sulphur, 0.005 per cent. The three irons were melted under the same conditions and were poured into molds 1 inch wide, ⅛ inch thick and 14 inches long. This was for the fluidity test. The first iron filled the mold 9¾ inches of its length, the second 8½ inches, and the third 14 inches, and the foundryman stated that he believed that if he could have gotten the end of the mold out quickly enough, it would have run to the end of the shop.

This, of course, was an enthusiastic exaggeration, but the test settled in that foundryman's mind that phosphorus and manganese were elements that affected the fluidity of iron fully as much as silicon. Also, that an iron which had this fluidity must also be low in sulphur. The product of this furnace is used almost entirely by foundries making steam, gas and air cylinders, ammonia valves and other castings which must be dense and free from pin holes, and yet soft enough to be reamed and cut.

The casting of pig iron in chill molds has very little, if any, effect on the character of the iron, especially if the foundryman uses a mixing ladle. It does not affect the total carbon at all, if anything it rather increases the amount of this element, for the reason that the surface of the pig iron is cooled quickly, in this way preventing the throwing off of "kish," which is so evident in a cast house when running hot iron. It somewhat increases the total combined carbon, owing to the sudden cooling or chilling of the surface, but if the iron contains the proper amount of alloys and is melted hot and tapped into a mixing ladle the casting will be as satisfactory in every respect as though the pig iron had been sand cast In addition the chill casting eliminates the sand and other dirt in which the sand cast pig iron is run.

A test was made several years ago by taking a pig of sand cast iron weighing it, and then pickling it, then reweighing it, and it was found that this particular brand of metal carried 70 pounds of sand to the ton of iron. This adds just so much to the impurities to be contended with.

METALS IN FOUNDRY PRACTICE

Questions from Practical Foundrymen are answered in this department by the following experts:

CAST IRON . . . . . W. J. KEEP
MALLEABLE IRON . DR. RICHARD MOLDENKE
METALLURGY OF STEEL . . . J. B. NAU

Other experts also contribute. Address all inquiries to the Editor.

CAST IRON NOTES

By W. J. Keep.

The following answers will indicate the questions without reproducing them:

The standard analyses of foundry irons according to the standards of American Society for testing materials, follows:

	Silicon.	Sulphur.
No. 1 foundry.....	2.75	.035
No. 2 foundry.....	2.25	.045
No. 3 foundry.....	1.75	.055
No. 4 foundry.....	1.25	.065

A safe analysis for machinery scrap is 1.75 per cent silicon, 0.065 per cent sulphur; store scrap 2.25 per cent silicon, 0.085 per cent sulphur.

Seventy-two-hour coke is a thing of the past, but foundry coke should not contain more than 0.80 per cent of sulphur, but very often it contains 1.00 per cent or even 1.25 per cent, but when above 1.00 per cent the sulphur will cause trouble.

Figure the silicon in your mixture and calculate a silicon loss of 0.30 per cent and a sulphur gain of 0.03 per cent. No phosphorus will be gained or lost, but about 0.11 per cent manganese will be lost. In small cupolas a 6-ounce blast will do good work and up to 16 ounces.

The thinner the casting the more silicon is needed, but it is not always practical to vary silicon for different thicknesses if made during the same heat. If you make castings one-half inch thick you should have about 2.25 per cent silicon. For castings 6 inches thick only 1.00 per cent.

Granulated ferro-manganese thrown in a ladle before it is filled with iron will lessen sulphur and will not harden castings, but will soften them. The best way to lessen sulphur is to melt the iron very hot.

FOUNDRY IRON.

Question:—What is the difference between No. 1 and No. 2 foundry iron, and when is it advisable to use the one and not the other? What kind of castings can be made of gray forge iron? What kind of iron should be used in mine car wheels? Would one-half ordinary machinery scrap and one-half burned grate bars have sufficient strength? I want to make tires and grinding plates very hard. Will ordinary white iron answer, or, would you mix gray iron with it?

Answer:—No. 1 iron should contain 2.75 per cent silicon, No. 2, 2.25 per cent and gray forge 1.50 per cent. If no analysis is made a very dark open-grained iron is No. 1. Not so even and closer-grained is No. 2. Gray forge is very close. The more silicon the softer the castings. You should use a chilling white iron. Some white iron is not hard; that is, the cutting edges will hammer down. Scrap car wheels are good. Chilling white iron will make very hard castings, and cutting edges may break off but will not turn over. A little gray iron mixed will give the strength desired. Burned grate bars are good for nothing but sash-weights and similar castings.

CRACKING OF BOTTLE MOLDS.

Question:—An iron chill 1¾ inches thick at bottom, tapering towards the top and with a one-inch neck forms the center of a mold 6 inches diameter and 7 inches deep, the outside tapering towards the bottom. We cast the mold from the top and find blow-holes near the top and often cracks just where the chill begins to narrow for the neck.

Answer:—Use a horn gate and pour

the casting from the bottom. The iron to use depends upon the hardness required. The sulphur in the casting should be low to enable the mold to withstand heat and to prevent the blow-holes. Use coke with sulphur as low as 0.7, and use good scrap.

OIL SAND CORES.

Question:—How can we hold oil sand cores together? Flour paste does not answer. When dry they fall apart.

Our gas engine cylinders have a boss on top as they are cast, and near the center on top fine dross collects and causes small blow-holes and leaks. We black-wash the cores.

Answer:—To one gallon of paste add ½ pint of black strap, (molasses), and the cores will stick.

Stop black-washing dry sand cores, and the dross will not appear.

STEEL SCRAP IN CAST IRON.

Question:—Will you please tell me if steel boiler scrap, sheet steel scrap, etc., are essential to cast iron? Does not a large per cent of such steel burn out while melting in a cupola?

Answer:—About 10 per cent, and up to 20 per cent steel cuttings from the edges of boiler plate are charged in the cupola to add strength to the casting, (semi-steel). A little aluminum in the ladle will make it fluid enough to run and will prevent blow holes. Thin steel scrap is not suitable and will blow out of the cupola more or less.

ROTATING CAR WHEEL MOLDS WHILE CASTING.

Inquiry.—We are interested in a new process for the manufacture of car wheels in which the mold is rotated while the casting is in progress. We have recently learned that such a method is now in use and would like to know the details of the process.

Answer.—Casting wheels in this manner was experimented with some years ago in Lyons, France. It did not prove a success. In the casting of a green sand mold, the cross contact of the iron with the pockets in the bracket side of the mold tore the sand to pieces on account of the necessity to ram this portion of the mold very soft to overcome shrinkage, as there is no way to overcome the difficulty in this class of a mold. In later experiments dry sand molds were used. They were able to turn out in this way good castings, but on account of the expense involved, they could not be made in a commercial way. Further, there was nothing to show in the castings that they had derived any benefit to offset the extra expense. As a matter of fact, the iron was not as homogenous as is the case when the molds are cast while stationary. The difficulty seemed to be that the velocity, as it went into the mold, was entirely downward, and the mold itself moved horizontally without any smooth open surface for the iron to pick up the movement of the mold, and the result was that more of the iron ran against the motion of the flask than otherwise. In other words, a wheel is poured in such a short space of time, say 12 seconds, without smooth channel ways, that the iron practically stood stationary and the mold revolved through it.

There were some experiments made in this country, but not nearly so extensive as those made in France, but without success. A. W. S.

COLD AIR IN OPEN-HEARTH PRACTICE.

Question.—If cold air were used for the combustion of the gas in an open-hearth steel furnace instead of passing it through heated checker work, as is customary, what effect would it have on the charge in the furnace? Would it take longer to run a heat and would it affect the elements in the heat differently than the hot air would?

Answer.—The virtue and efficiency of the open-hearth process is dependent entirely upon the fact that the air needed to support the combustion is passed through regenerators or checkers in which waste heat has been stored, thus pre-heating the air before work begins. It would not be practical with medium or low carbon steel to get good results by neglecting to pre-heat the air required in a furnace of the open-hearth type.

W. M. CARR.

THIN CASTINGS WITH HARD CORES.

Under the head of "Cast Iron Notes," in your February issue, Mr. Keep dealt with a thin casting having a hard core, the two outer sections being soft. The silicon content was placed at 3 per cent. Inasmuch as Mr. Keep stated that he was unable to explain the phenomenon the following suggestion may be of value. Having had similar castings submitted in the past, I have found upon careful investigation that these peculiarities are produced by too much blast for the amount of coke used. The iron is decarbonized and as a result there is not sufficient carbon present for the silicon to exercise its influence upon. The soft gray outside sections have absorbed carbon from the mold. I would suggest lowering the blast pressure.

ROBERT BUCHANAN.

RAPID DETERMINATION OF CARBON IN IRON AND STEEL.

James A. Aupperle, Indianapolis, exhibited an apparatus of his own design and gave a practical demonstration of the rapidity with which samples of iron or steel borings could be oxidized in a few minutes with the use of a single Bunsen burner, at the Carnegie Technical Schools, Pittsburg, Feb. 21, under the auspices of the Pittsburg section of the American Chemical Society.

The borings were placed in a platinum boat in which a layer of coarse emery was used to prevent the fused oxides of iron from sticking to the boat. They were also covered with coarse emery which caused the oxides to assume an oval form and prevented them adhering to the side of the boat. When no emery is used as a cover for the borings, it was shown that the upper surface of the oxides assumed a concave appearance and would spread and adhere to the side of boat.

The boat was inserted in the combustion tube which was 6½ inches long, the educt tube was bent back and returned through the fire chamber and through the water jacket making practically 13 inches of heating surface, thus making it feasible for a single Bunsen burner with a wing top flame spread to 6 inches to quickly heat the combustion and educt tubes.

While it is a recognized fact that hot solid platinum will promote the combination of carbon monoxide and oxygen and cause all the carbon to be evolved as carbon dioxide, it was found that the platinum in the Aupperle Combustion apparatus would in time become brittle, from having this oxidizing to do. This was corrected and overcome by the manufacturer of the apparatus, who suggested the use of a ring consisting of several layers of fine mesh platinum gauze to be placed adjacent to the junction of combustion and educt tubes which serves the purpose of oxidizing all carbon monoxide to dioxide. This advantageous change applies to the crucible as well as the combustion tube.

The results of the evening were based on a standardization of a single determination of a standard steel containing 1.24 per cent carbon, which would mean that this result must be absolutely correct, as an iron containing three times this per cent of carbon was calculated from this factor.

In titration, the hydrochloric acid was run into the mixture of barium hydroxide, and barium carbonate, until the pink color produced by the Phenolphtale almost disappeared. The solution was then titrated back to deep pink with barium hydroxide or until a drop produced no deeper tint where it strikes the solution. This titration to a deep pink evoked some discussion in reference to the reason, and it was shown that in a nearly neutral solution the reaction was slow, and that both acid and alkali could exist as such for a short time in the same solution and would thus give an end point that would be uncertain and would soon fade out.

To get the correct end point, the solution was left alkaline. This inability of acid and alkali to combine in a nearly neutral solution was illustrated with a sample of water used for boiler purposes, in which most of the scale forming material had been removed by soda ash and lime. Even though the solution was alkaline to Phenolphtalein, the water still contained a few grains per gallon of sul-

phate and bicarbonate of lime in solution, which would only be separated by boiling or an excess of alkali.

The next sample analyzed was an alloy steel containing 0.73 per cent carbon, in addition to chromium, tungsten and molybdenum. This sample was burned ten minutes, and in fifteen minutes from weighing the sample, it was reported 0.733 per cent using two grams of steel.

In the discussion of alloy steels it was suggested that molybdenum might be volatilized and cause high results. Mr. Aupperle did not think it could cause any error on account of the remarkably concordant results obtained on this sample, besides the oxides fusing would suggest the possibility of retaining the molybdenum.

The next sample were drillings of cast iron and burned ten minutes. Some barium hydroxide was lost causing the high result previously mentioned.

One of the members of the American Chemical Society then submitted a sample for analysis without mentioning the carbon contents as found by other chemists. The sample was burned only eight minutes and in twelve minutes from weighing the sample, Mr. Aupperle reported 3.70 per cent carbon. The sample contained 3.67 per cent of carbon.

NEW STEEL CASTING PLANT.

A converter steel casting plant having the capacity of 20,000 pounds daily will be built by the Curtis & Co. Mfg. Co., St. Louis, manufacturer of foundry cranes and saw mill machinery. Small castings will be made not only for the company's own use, but to meet outside requirements as well. The equipment will consist of two 3-ton converters, which are now being designed, as well as two cupolas in which the iron will be melted. The double installation provides for the idleness of each unit on alternate days to permit of such repairs being made as may be necessary. The foundry building will be of steel construction covered with galvanized iron, with dimensions 220 x 95 feet. A concrete sand shed 30 x 80 feet will also be built, in which the various grades of sand used in the foundry will be stored.

It is not an uncommon occurrence in these barometric days of high and low pressures in the iron trade for foundries to close temporarily as a result of the pig iron shortage. Illinois, Wisconsin and the Dakotas failed to harvest their full quota of hay last year, but even the most pessimistic was not bold enough to venture the prediction that the decline in tonnage would materially affect the production of cast iron pipe, "yet such is the case," as the cub reporter would say. One large pipe plant bordering the great lakes was compelled to suspend operations for about ten days recently as a result of the hay shortage. In this connection it should be explained that marsh hay is used largely for making pipe cores, one concern alone using about 1,000 tons annually. Sawdust has been used in some pipe foundries, but most of them have been more successful with hay.

* * *

Pat, a patternmaker friend, takes exception to articles on gear making and propeller wheels, and makes a few pertinent suggestions as follows:

"I don't know of any two subjects in mechanics that will disgust a patternmaker as quickly as 'Gear Making' and 'Propeller Wheels,' and it is my wish, as well as that of a number of brother patternmakers, that the editor of THE FOUNDRY will cut this out of his valuable journal and that the iron and brass molders, also wood and metal patternmakers, will encourage this move.

"During the past 25 years I have been a subscriber to mechanical journals and I think I may say three out of every five issues had an article on gears or propeller wheels. Not long ago I paid a visit to the Elgin insane asylum, and in one of the wards I noticed a man walking and looking up over the windows. I at once concluded he must be a patternmaker looking for work, but the keeper said his trouble was the result of trying to keep track of the different methods for laying out and constructing a wood

gear pattern and propeller wheels.

"I have been a patternmaker 25 years and have been employed in the best shops in this country; have made gears of all kinds; have seen the apprentice boy make gears when he could not make any other patterns with half the success, and yet you read in mechanical journals and correspondence schools instruction papers, nothing but gears, gears, gears.

"What is there in the construction or making of a gear pattern that is the cause of all this waste of valuable space in mechanical papers. Thirty years ago a patternmaker that could make a good gear was considered a 'crackerjack' mechanic. Not so today. Factories in this line take your order and turn out gears while you wait. I put in about one year in a factory where gears were a specialty. The draftsman had a small drawing board, a gear chart, a few drawing tools, and with these he turned out drawings for any and all kinds of gears. These gears were shipped to machine shops throughout the country, and why was it that the managers of these shops sent away for gears when they have pattern shops, foundries and machine shops of their own? Simply because they can get just what they want in one-half the time, at one-half the price, and they are not obliged to study all the new fangled methods written about the construction of the 'gear pattern.'

"About one shop in every 500 makes, or cares to make, or bother with, a pattern for a propeller wheel, and yet to look over the papers or books one would think they were made and sold like toy balloons.

"I talked with a pattern maker today who has been at the bench 31 years, and during all this time made 16 gears and not one propeller wheel."

* * *

The Hoosier state, home of George Ade and several near-great foundry jokesmiths, once more insists that the spot-light be turned its way. The manufacture of castings by a patented process is the event of the day in the foundry world which temporarily compels other states in this great union to step aside and accord Indiana the privilege of the center of the stage. The process consists of the application of a liquid prepared according to a secret formula to parts of the mold coming in contact with those portions of the casting's surface which it is desired to treat. It should be noted that although the entire operation has been patented, the liquid formula is secret. No explanation, however, has been given regarding the method pursued in the patent office to secure monopolistic rights on the application of a liquid to molds. By the use of this dope any degree of hardness, it is claimed, can be secured, over any portion of the surface of the castings, the depth of the chill depending entirely upon the amount of the liquid applied. Chilled roll and car wheel works have undoubtedly been overlooked by the exploiters, and it may not be amiss to suggest to them these plants as fertile possibilities for future endeavor. Success to the venture.

* * *

An eastern correspondent, who has had many years' experience pounding sand, saddles the cause of spongy castings on the foreman. He says:

"I have seen a great many articles published recently concerning castings that are spongy or full of sand holes, generally known as shot. It was stated that in turning such castings, the point of the tool was invariably broken when a shot was struck. Every article that I have read seems to lay the blame on the iron and sometimes on the chemist who has made up the charge, although I believe the fault should be saddled on the foundry foreman. At the beginning of my career as a molder, I was taught to rap all the loose sand from my castings, my tutor having informed me that this sand was the best that could be procured, and for this reason it was always carefully heaped. Some will say that the use of this material will make the sand rotten, but I have worked on one floor for three years at a time and did not waste very much sand, as I did not require more than three or four wheelbarrows a year. In addition, the sand on my floor was strong and my castings were always free from shot or other defects. We made a heat every working day and I believe that spongy, shotty castings are always caused by using too much new sand."

LENGTH OF CHORDS

By Chas. E. Simmons

Every patternmaker or molder frequently has to ascertain the length of a chord, as in segment work in connection with the cores or core boxes. The accompanying table and diagram show how this may be accomplished.

To find the length of any chord multiply the figure opposite the number of spaces desired by the diameter of the circle. For instance, if the wheel is to be divided into eighteen segments and is 40 inches in diameter, it is necessary first to look opposite 18 in the first column of the table, where we find 0 1736. Multiplying this by 40 we have 6.944 as the length of the chord.

Table for Computing length of Chords.

		26	.1205	51	.0616	76	.0413
		27	.1161	52	.0604	77	.0408
3	.8660	28	.1120	53	.0592	78	.0403
4	.7071	29	.1081	54	.0581	79	.0398
5	.5878	30	.1045	55	.0571	80	.0393
6	.5	31	.1012	56	.0561	81	.0388
7	.4339	32	.098	57	.0551	82	.0383
8	.3827	33	.0951	58	.0541	83	.0378
9	.3420	34	.0923	59	.0532	84	.0374
10	.309	35	.0896	60	.0523	85	.0370
11	.2817	36	.0872	61	.0515	86	.0365
12	.2588	37	.0848	62	.0507	87	.0361
13	.2393	38	.0826	63	.0499	88	.0357
14	.2225	39	.0805	64	.0491	89	.0353
15	.2079	40	.0785	65	.0483	90	.0349
16	.1951	41	.0765	66	.0476	91	.0345
17	.1838	42	.0747	67	.0469	92	.0341
18	.1736	43	.073	68	.0462	93	.0338
19	.1646	44	.0713	69	.0455	94	.0334
20	.1564	45	.0698	70	.0449	95	.0331
21	.1490	46	.0682	71	.0442	96	.0327
22	.1423	47	.0668	72	.0436	97	.0324
23	.1362	48	.0654	73	.043	98	.0321
24	.1305	49	.0641	74	.0424	99	.0317
25	.1253	50	.0628	75	.0419	100	.0314

TECHNICAL FOUNDRY EDUCATION

In the March number of The Foundry H. E. Field, of Pittsburg, in writing on foundry education, called attention to the fact that our educational institutions without exception fail to recognize the real "meat in the cocoanut" and are content to furnish a mere smattering of foundry knowledge. In my opinion the knowledge transmitted in most of these schools is not worthy of being mentioned as even rudimentary.

These kindergarten arrangements whereby hours are spent by the students in elementary work and which are looked upon as merely recreation hours can be made extremely profitable. An intelligent and competent man should be placed in charge, who has the ability and knowledge to take the boys into a pit and teach them the proper way of making a bed, the various methods of carrying away the gases, the venting of pockets, the use of the proper sands, gating, and the reasons why the iron should enter the molds at certain points and the speed at which the metal should flow. In addition they should be taught how to construct the cores, they should have some knowledge of the different types of cores, and the proper core sands to use. Instruction should be given in the proper use, operation and equipment of molding machines, cupola practice, the charging of coke, pig iron and scrap, ladles, their use and maintenance, and some idea should be given of the different drying and annealing ovens in use.

The lighting and ventilating of shops is another important item, as well as power-conveying systems, etc. There are other details too numerous to mention.

B. D. Fuller.

NEW PLANT OF THE DETROIT STEEL CASTING COMPANY

A Well Equipped Foundry for the Manufacture of Open Hearth and Converter Steel Castings

Facilities Adapted to General as Well as Special Work

THE plant just completed, which has been built by the Detroit Steel Casting Co. to replace the one destroyed by fire Feb. 19, 1905, was constructed with the primary object of obtaining a complete and modern steel casting foundry of adequate size and perfectly fireproof. In this attempt splendid success has been attained. The location on the Bay City division of the Michigan Central where it crosses Michigan avenue, provides excellent shipping facilities. All of the buildings, including the office which faces Michigan avenue, are of heavy brick and steel construction, and are arranged as shown in Fig. 3, which is a layout of the whole plant. A large variety of work is handled, but a specialty is made of steel castings for marine engines and dredging machinery, railroad car castings and knuckles for car couplers. The foundry has an average daily capacity of 60 tons of finished castings.

No attempt has been made to provide a foundry of unique features, but ease and efficiency of operation under working conditions have been carefully plan-

FIG. 1.—CONVERTER DEPARTMENT OF DETROIT STEEL CASTING CO.

ned for in every detail of the arrangement of yards, buildings and equipment. The main foundry building is a steel structure with heavy brick walls 500 feet long and 165 feet wide, built with three longitudinal bays. Practically all of the molding is done in the wide, roomy and high middle bay which has a height of about 40 feet from the floor to the roof, and thus provides excellent ventilation. It also receives the full benefit of the specially designed roof in the matter of superior light. The roof of every third cross sectional bay is lowered, which arrangement provides for the placing of vertical windows on the four sides of the elevated bays, permitting the ingress of light from all directions.

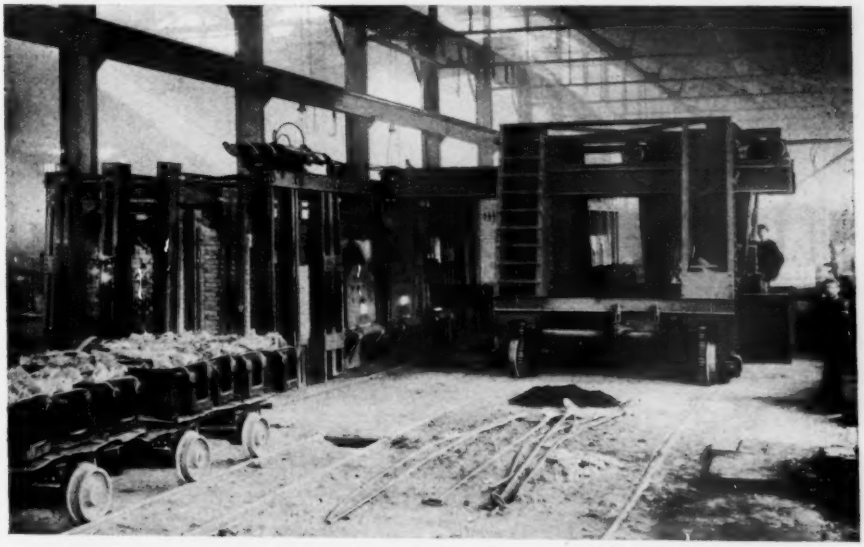


FIG. 2.—OPEN-HEARTH FURNACES AND CHARGING MACHINE.

The middle portion of the bay is used as the pouring floor, with the dry sand molding in the metal flasks on one side and the green sand molding, largely with metal patterns, on the other side. It will also be noted that in the side bays are the open-hearth furnaces on one side and on the other side the drying ovens directly opposite and adjacent to the pouring floor, affording the easiest possible handling of metal and molds.

Adjoining the green sand casting floor is the cleaning floor, where the castings are dumped from the flasks as soon as cooled. The reason for having the green sand and dry sand molding so located with regard to the rough cleaning floor arises from the fact that the quick-cooling green sand castings in the wooden flasks are immediately at hand to be dumped first and gotten out of the way before the dry sand castings are ready. At the same end where the castings are cleaned, so that but slight traveling with the castings is necessary, is a large double annealing furnace built in the ground. It is constructed of fire-brick and the over-all dimensions are 12 x 48 feet by 8 feet deep. The furnace has two heating chambers with a fireplace at each end, both of which are provided with a grate for burning either oil or coal. One end of it is fired from the outside of the foundry, the furnace projecting through and under the wall. The heating chambers are in the middle of the furnace, separated by a transverse fire-brick wall, as shown in Fig. 4. The heat passes from the fire box over a low fire wall into the heating chamber, the draft passing out at the rear end through flues which lead underground to a chimney. The walls rise a foot and a half above the floor and are crowned with a cast iron plate which runs the entire length and affords a durable support for the arched roof of the furnace. This roof consists

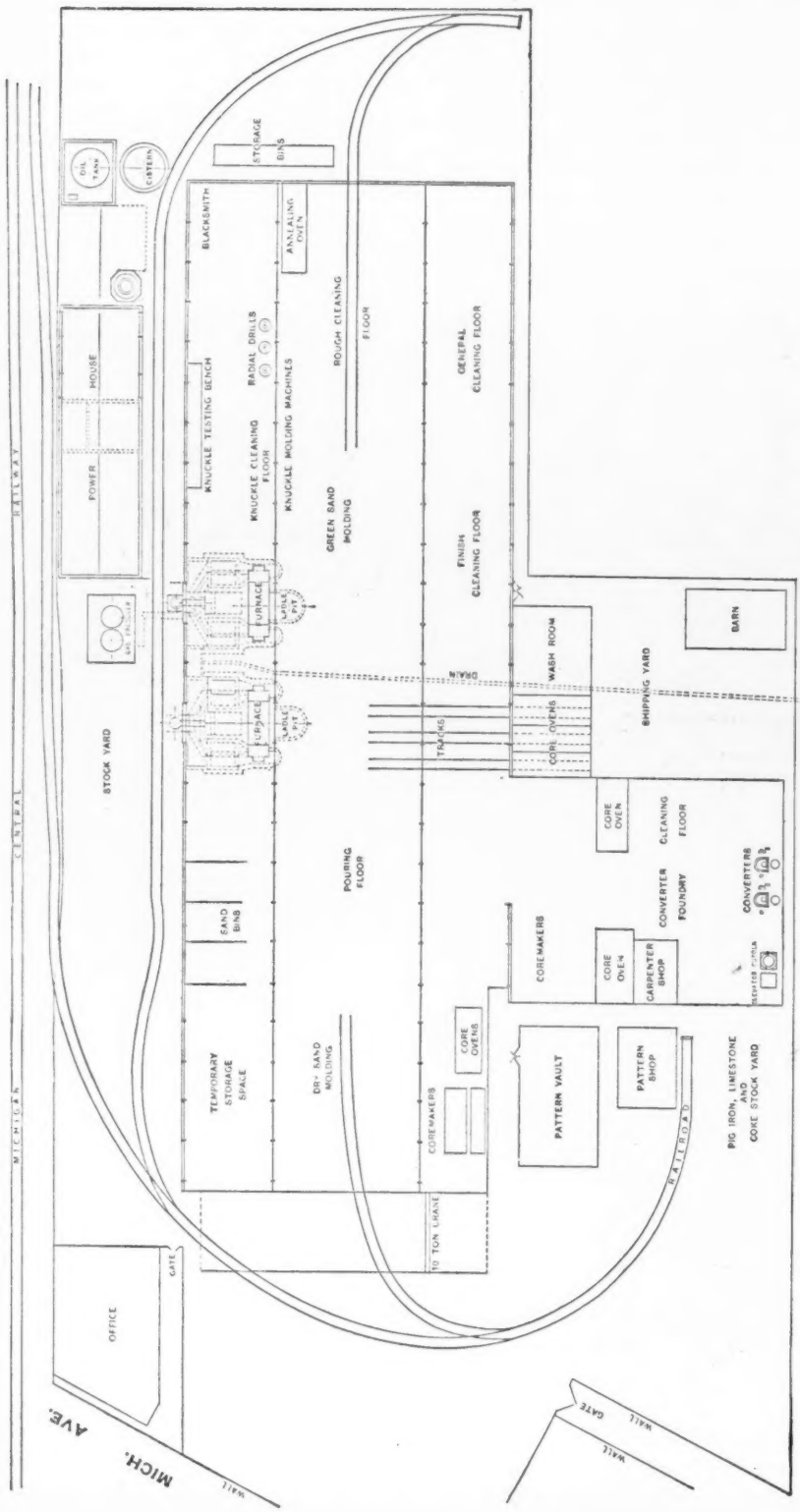


FIG. 3.—GROUND PLAN, PLANT OF THE DETROIT STEEL CASTING CO.

of cast iron covers in the form of circular segments about 42 inches wide. Each segment is provided with a hook to facilitate lifting on and off by the cranes. A large plate, which fits into the bottom of the furnace, is loaded with the castings to be annealed and picked up by the crane and placed in the furnace, so that a large number of pieces are thus handled with one operation.

The middle bay can be served throughout its entire length by any one of the five cranes which span it. Two of these are of 30 tons capacity and three of 10 tons, all electrically operated. One 30-ton crane was built by the Northern Engineering Co., Detroit, and the other by Pawling & Harnischfeger, Milwaukee, while the three smaller cranes were built by the Northern Engineering Co., Detroit.

The open-hearth furnaces occupy the middle part of one of the side bays, being located, as mentioned above, at a point where the metal can be distributed most easily for pouring. A view of the furnace installation is shown in Fig. 2. There are two furnaces, each with a rated capacity of 15 tons, though they are commonly worked up to 18 and 20 tons. The basic process is used here, as is coming to be the more common practice generally, because of the greater ease in manipulation and economy, one evidence of this latter feature being the possibility of buying high phosphorus scrap, which can be used in the basic open-hearth process, at a lower price than that at which the scrap from the basic open-hearth castings, a low phosphorus product, can be sold to foundries where the acid process is used.

Oil is used as a fuel for heating throughout the foundry, and in the open-hearth furnaces two oil burners of the Kirkwood type are used, one on each end. Every 15 minutes the burners, which work one at a time, are reversed in connection with the operation of the regenerator chambers located beneath the furnaces and the opposite wall and underneath the foundry flooring. For each furnace there are two of these regenerators, the one for air being 12 x 9 x 6 feet, and the one which has been provided for the possible use of producer gas as a fuel being 19 x 9 x 4 feet. The operation of the regenerators is controlled from above by means of valves and levers, which provide for the reversing of the current of gases as the burners are alternated.

FIG. 4.—ANNEALING OVENS FOR LARGE CASTINGS.

Each furnace has three charging doors and a Wellman-Seaver-Morgan charging machine handles the scrap for the furnace in the usual way. The purchased scrap is stored in the yard at a convenient point, so that, with the trackage facilities provided, the loaded charging trays may be weighed and run in to the charging machine. Part of the scrap used from the foundry is stored inside from the Massillon district. In front of the bins are three American Clay & Machinery Co.'s sand grinding pans, electrically driven, one with a 5-foot, one with a 7-foot and one with an 8-foot span. The extreme end of this side bay is used for a temporary storage of the flasks and patterns. At the other end of this bay, beyond the open-hearth furnaces, a small space is allotted to the repairing

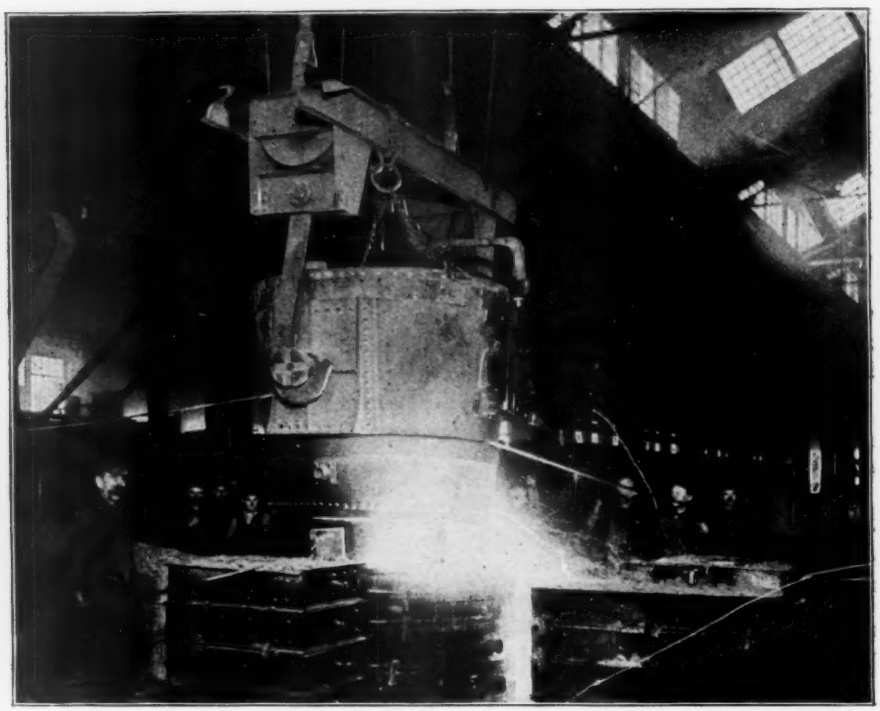


FIG. 5.—POURING FROM THE 20-TON LADLE.

near the furnaces, and there are scales installed for its convenient weighing. Analyses of the charge and the metal are made daily and submitted to the office, the company's own laboratory being installed at the plant.

The casting pit directly at the rear of the open-hearth furnace is in the middle bay in the pouring floor mentioned above. There are three casting ladles, each of 20 tons capacity, which are heated in preparation for pouring by oil burners. They are of the ordinary type, as shown in Fig. 5 taken during the pour.

In the same bay farther to the front of the foundry are the bins for sand, the greater portion of which is obtained of the flasks that may be more or less damaged by use, and also a space is given for the cleaning of the car coupler knuckles. In the middle bay, adjacent to this cleaning space, are eight Maywood Foundry & Machine Co. molding machines, with which the knuckle molds are made. The casting and cleaning operations are accomplished side by side and the knuckles are then ready for testing, a wall bench fitted with a number of couplers being installed nearby, so that every piece that leaves the foundry is ready for immediate service. Three 42-inch radial drills built by C. C. Wormer, Detroit, are conveniently located for reaming out the knuckles preparatory to testing them.

A large steel rumbler, motor driven, is also a part of the equipment of the knuckle cleaning department. A Williams-White 1,500-pound press has been installed for straightening railroad car center plates, avoiding the former method of straightening by the blacksmith.

The location of the drying ovens in the bay on the opposite side, with regard to the pouring floor, has been mentioned, but in reality these drying ovens are in a wing built to the main foundry, the other part of which is used for an employes' washroom. These drying ovens are three in number, and are about 8 feet high x 15 feet wide and 40 feet deep. They are heated by oil burners located at each corner, in front of the oven. The doors of these ovens are of jointed sheet metal and can be rolled up into hangers when the oven is not in use. The tracks on which the trucks carrying the molds are run into the ovens extend out into the pouring floor in the middle bay.

In the front end of this bay is the core makers' room. A core makers' bench extends along the column side of the bay and on the wall side are three core ovens set parallel to the wall with tracks running through them to provide for the handling of cores in and out. These ovens are also heated by oil burners through flues which pass underneath the oven and open upward in the bottom. In the accessible wall of the ovens a number of small compartments are built, as shown in Fig. 6, each compartment having an iron door through which small cores may be set in. There are 12 of these wall shelves in one oven and 16 in the other, thus providing a much more efficient use of the wall space than otherwise possible. Racks also are installed in the ovens for the drying of a number of the cores, utilizing all available space.

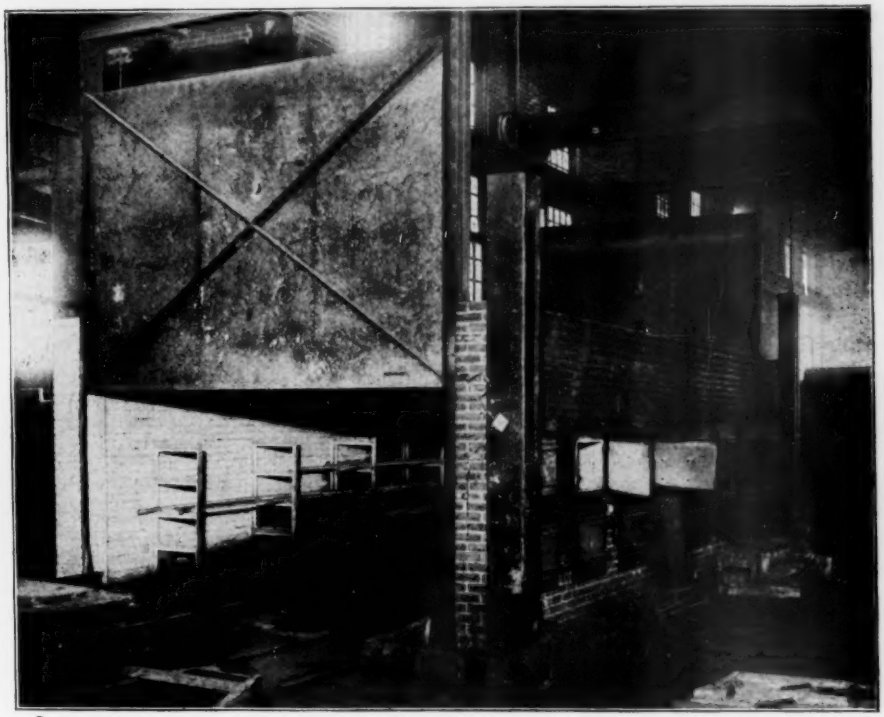


FIG. 6.—CORE OVEN IN MAIN FOUNDRY, SHOWING SIDE DOORS.

At the other end of the bay, the cleaning of the finished castings is done. Deliveries are made from this department, the building and yards being planned with shipping facilities to meet this ar-

rangement. In cleaning the castings, a great many air tools are used for chipping, and space is allotted nearby for the dressing of chisels as repairs become necessary. A considerable number of tools are installed to aid in cleaning, saws, shapers and grinding machines, among which are five swinging emery grinders. Throughout the foundry the tools are driven either by individual motors or group drive, the electrical installation being partly Westinghouse and partly Fisher Electric Co. of Detroit. Spanning this bay are three five-ton electric cranes, two built by the Browning Engineering Co., and one by the Fisher Electric Co., and over the bay on the opposite side is another five-ton Browning crane.

The converter castings department, shown in Fig. 1, which was a part of the old foundry and which can now be operated entirely separate from the main foundry, is located in what is now a wing of the main building, extending, as indicated in Fig. 3, from the northwest corner. In this department the smaller acid castings are made, such as those required in automobile construction. Two 11.2 ton Robert converters, electrically operated, supply the metal. The tilting of the converters is accomplished through a driving mechanism consisting of a worm wheel and gear with a reducing gear and pinion connected to an individual motor. The converters use a blast of 3½ pounds pressure per square inch, air being stored in a cylindrical tank, which is suspended in a horizontal position directly under the roof of the building. The pig iron for the converters is melted in a 54-inch Colliau cupola, which is located alongside the converters. Blast for the cupola is furnished by a motor-driven Sturtevant blower. An electric elevator alongside the cupola provides the means for access to the charging floor. Directly in front of the elevator is a Fairbanks floor scale for weighing the material used, coke, pig iron and limestone being stocked in the yard immediately outside of this end of the building, so that they are directly at hand. In front of the converters a room has been enclosed for such carpenter work as may be necessary. The molding floor occupies the central portion of the wing. At the same end, but on the opposite side from the converters, are annealing ovens, and conveniently located with respect to the delivery door, which opens into the same shipping yard as mentioned in connection with the main foundry, are a number of bins for the storing of castings ready for shipment. On the same side of this foundry is a cleaning department, where all the hand cleaning is done with pneumatic chippers and where a number of saws, stationary and portable emery grinders, are installed. The tools for this cleaning department are driven by group drive from a large Westinghouse motor. Two Fisher cranes are available in this department for the movement of molds and material. At the inside end of this wing facing each other, one on each side of the room, are two large core ovens capable of handling all the work of this department, and so located that a minimum of time is lost in moving material. This department also has its own core room.

The pattern shop and pattern storage vault are conveniently located with reference to the foundry, and have been constructed as nearly as possible fireproof. In the pattern shop, as well as elsewhere in the plant, the tools are electrically driven. The shelves in the vault for storing the patterns are made of expanded metal with wrought iron pipe uprights. The windows are covered with ordinary Kinnear fire doors, and, in every respect, the construction is adapted to the safety of the patterns. This building is two stories high.

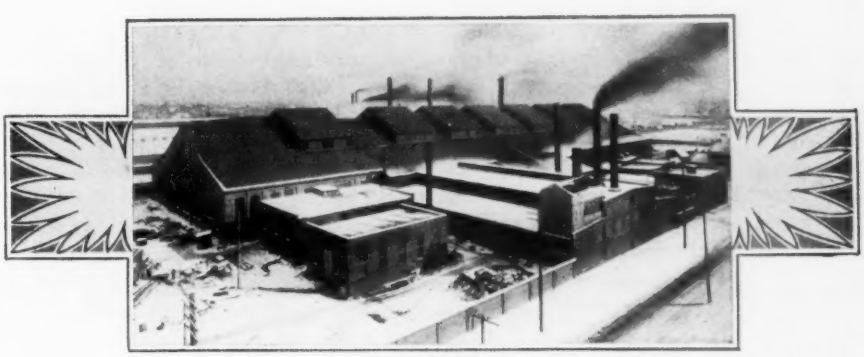
The power house, which is located alongside of the railroad with the resultant advantages of coal and ash handling, is a brick building 140 feet long by 42 feet wide. There are installed in the boiler house three 200-horsepower water-tube boilers, equipped with automatic stokers and built by the Ricard Boiler & Engine Co., Toledo, O. The feed water is supplied through a Cochrane hot water heater. Between the boiler room and the engine room, which are in the same building, is considerable space devoted to locker and storage rooms, preventing the dirt of the boiler house from

entering the engine room. The engine room itself is finished in white brick with tile floor, and presents a pleasing appearance. Power is developed by two Skinner engines, one driving a 250-kilowatt General Electric generator, the other a 125-kilowatt Westinghouse generator. A 30-kilowatt Akron machine, direct-connected to an Erie engine, is used as an auxiliary unit. For the pneumatic tools used in the cleaning department of the foundry, two Ingersoll-Rand air compressors have been installed, having a capacity, respectively, of 610 and 1,020 cubic feet of air per minute. The blowing engine for supplying the blast to the converters is of the vertical type, built by the Wymer Machine Co. of Lebanon, Pa. The several electric motors, together with the lighting, constitute the load on the power plant. An oil storage tank, having a capacity of from 600 to 800 barrels, from which oil for all the heating in the foundry is supplied, stands just at the rear of the boiler room.

Immediately in front of the power house is a gas producer plant, which, though it has never been used owing to the great satisfaction obtained from the use of oil as a fuel, is located in line with the open-hearth furnaces in the foundry, for which it is intended to supply fuel.

The yard facilities for serving the foundry have been looked to as carefully as the arrangement in other particulars. A system of trackage has been laid out, as shown in Fig. 3, so that the main foundry can be entered from either end for the handling of scrap or castings directly into railroad cars and a 10-ton Browning Engineering Co.'s locomotive crane operates in the yard. Across the entire front of the foundry, 165 feet and with a span of 40 feet, a 10-ton yard crane has been erected, which consists of an air hoist mounted on trucks to be hauled along the crane runway by hand. This is for the handling of flasks, patterns and lighter loads.

The various materials required for the different departments of the foundry are conveniently stocked about the buildings in the yard. At the rear of the foundry is a row of 37 storage bins, in which every variety of car coupler knuckles properly classified is kept in stock, an attempt being made to have 1,000 of each of these on hand at all times. This plant was designed by the Garrett-Cromwell Engineering Co. of Cleveland, and built by Whitehead & Kales Iron Works, Detroit, with the exception of the power house, which was built by the Russell Wheel & Foundry Co., Detroit.



BRASS FOUNDING

THIS DEPARTMENT IS DEVOTED TO THE TREATMENT OF ALL ALLOYS

POINTS FOR BRASS FOUNDERS

By a Practical Traveling Man.

During the past two months contracts have been awarded for over 30,000 freight cars, to say nothing of the engines and passenger coaches purchased. When one stops to consider just what this means to the brass business, it looms up like a mountain. The cars range from 60,000 to 100,000 pounds capacity, and require journal brasses of the standard M. C. B. type, 3¾ inches by 7 inches, 4¼ inches by 8 inches, and 5 inches by

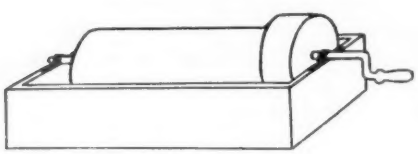


Fig. 1.—Tinning Plant.

9 inches, respectively. Taking the 80,000 pound car as an average, as each has eight bearings having a finished weight of 14 pounds apiece, 240,000 bearings will be needed, weighing 3,360,000 pounds, or 1,680 net tons of brass castings. Carrying the calculation further, this would make a train of 82 cars, each loaded with 40,000 pounds. There are two methods of manufacture in this branch of the business, as in others. The good, indicating work from a standpoint of quality and finish. The other, the best thing that can be given for the least money. There are likewise two ways of finishing this work, the bored and the unbored boxes. To be thoroughly equipped for this line of manufacture, a boring machine of the most modern type must be secured, as the best tool is the cheapest in the end, and a poor tool is dear at any price. A first-class molding machine is also needed and there are many in the market to choose from. A high speed wire brush for cleaning this class of castings is much quicker than the tumbling barrel.

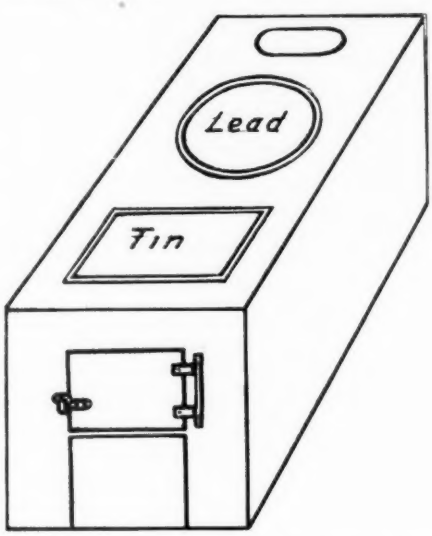


Fig. 2.—Furnace for Tin and Lead Pots.

Tinning Plant.

The tinning plant should consist of an acid roller made of vulcanized rubber, which revolves in a one-piece cast lead box as shown in Fig. 1. Three sizes are required, one for each of the master car builder's standards. White acid is used, or soldering fluid, which is made by cutting muriatic acid with zinc, using the sheet scrap, which is fed in until the acid has dissolved all that is soluble. A gallon can be made at one time and set away in a glass jar for future use.

After the castings have been cleaned and bored, they are ready for tinning and

for the lead lining. After they have been dried thoroughly they are immersed in the tinning pot. After being withdrawn they are placed on the acid roller, and that portion which is to hold the lining is thoroughly coated. After tinning the castings are again immersed in the tin pot and the box is then set into the mandrel and the lead lining is poured. The furnace for the tin and lead pots is shown in Fig. 2. To handle the work successfully it will be well to have at least six mandrels of each size, in order that the others may be used while three are cooling. The mandrels are fastened to a table or bench and the boxes are held in place by a clamp. For the final finish the lead fins are trimmed off and the sharp edge smoothed with a draw knife, and the casting is then ready for the market.

Trade Requirements.

After a plant has been equipped and is ready for business, the next thing is to ascertain the wants of the trade and to supply them. The material for this class of work is, as a rule, specified by the companies that realize that the best is always the cheapest, and they usually insist upon having old phosphor bronze, which has given such excellent service for the past twenty-five years. These mixtures can be made in two ways, one carrying 10 per cent of lead and the other 20 per cent. The formula for the first is 80 per cent copper, 10 per cent phosphor tin and 10 per cent lead. The second contains 70 per cent copper, 10 per cent phosphor tin, and 20 per cent lead. These formulas will make among the best cool running bearings that are on the market today. Extra precautions must naturally be taken in making castings from these mixtures, inasmuch as they contain so large a percentage of lead. By casting the boxes with the boring face in the drag and allowing them to cool before shaking out, bearings will be secured that resemble the one shown in Fig. 3. Small circles represent the little lead globules that have set next to the face, and when this box is bored a surface is secured that takes the tin coating well and, together with the lead lining, it is sure to adhere until the box is entirely worn out and is a positive anti-friction metal.

Chilling the Castings.

It may be necessary in making some of the borings from these formulas to use the method of chilling the casting quickly, so that a more even distribution of the lead content may be secured, as the addition of so much lead to the copper and tin used produces a plastic metal and does not set as rapidly as other

FIG. 3.—JOURNAL BEARING.

mixtures. The molds can be shaken out while the castings are still hot, but sufficiently set so as not to break, and they can be quickly chilled in water. This prevents the lead from working to the outer surface of the casting and gives a more even distribution of the lead content. Castings when containing lead and phosphorus are very fluid and sharp and cut into the sand. Facings such as sea coal and plumbago are used on the molds to prevent this cutting and when brushed up to finish, the skin will have a dark color. The entire compound is a mechanical mixture, as there is no affinity between lead and copper in such large proportions. It, therefore, requires experience to make castings of phosphor bronze, but when once accomplished, little difficulty is experienced in securing the same results thereafter.

Second Method.

The second method is the cheapest way to produce these castings. Good metal can be used and a fine article produced without the boring machine, but in this event the castings must be thoroughly pickled and washed to remove the dirt and grease spots, so that the tin will take hold, as the holding of the lead lining is very important. The pickling vat must be lead-lined, the seams turned over from the outside, and the solder must be used only where the acids cannot attack it, otherwise leaks will occur.

All this should be done as far as possible in one place, as repeated handling will greatly increase the expense. As far as the composition of the metal for the second method is concerned, it differs little from the first, and depends largely upon the customer. If he wants cheap goods, anything that will melt and hold together will satisfy him, but such goods are hard on good tools.

ALLOYS OF ALUMINUM AND COPPER.

The eighth report of the Alloys Research Committee was presented to the Institution of Mechanical Engineers, London, by Dr. H. C. H. Carpenter and C. A. Edwards on January 18. Dr. Carpenter said that the research had been carried out by the authors with the cooperation of the Broughton Copper Co. and the British Aluminum Co., who had furnished respectively the best commercial copper and aluminum for making the alloys, had undertaken the rolling and drawing of the materials, and had made special castings where necessary. More than 1,000 tests had been made, exclusive of about 200 specimens that had been microscopically examined and photographed. These results were classified in the various sections of the report, and the number of alloys that had been found of any industrial and technical promise was small, such alloys being chiefly those very rich in copper. At this end of the series the limit of serviceable alloys must be placed at 11 per cent of aluminum; at the other end of the series the limit was even smaller. Among the specifically light alloys rich in aluminum the limit was probably not higher than 4 per cent of copper. Between 11 per cent and 96 per cent of aluminum, the alloys did not appear to be of any practical promise. If the range of serviceable alloys was narrow, however, their quality was certainly high in several instances. This statement held for certain of the rich copper alloys containing between 7 and 10 per cent of aluminum, and it was not going too far to say that in certain respects the best of them equaled and even surpassed high quality steels of the same general character. The research had brought to light several striking instances of the profound influence of a small quantity of aluminum upon copper, notably in the tension tests, but especially in the torsion and electrical conductivity experiments. One-tenth of 1 per cent raised the angle of twist of copper in torsion 90 per cent; it lowered the electrical conductivity 23 per cent. The behavior in torsional stress of the alloys containing from 0.1 to 7.35 per cent of aluminum was one of the outstanding features of the report. The alloys containing from 5 to 10 per cent of aluminum had come well out of the dynamic stress tests. In this respect they were markedly superior to the iron and steel specimens hitherto investigated. At about 15 per cent of aluminum, the alloys were entitled to rank with quenched steels in hardness. In the corrosion tests, which were purposely made as severe as possible, alloys containing from 1 to 10 per cent of aluminum had shown themselves to be practically incorrodible by sea-water, whether alone or bolted to a plate of mild steel.

CASTING LINERS AND PUMP PLUNGERS.

The article describing the brass liner for pumps which appeared in the February issue of THE FOUNDRY interested me very much, as I have had considerable experience casting both liners and pump plungers for sugar mills, which require a large number of pumps of all sizes. I do not agree, however, exactly with the method of gating suggested. The most successful plan I have found and which I have used for a number of years is to run from the top, in a liner such as was mentioned. My gate resembles a fin about 1-16 of an inch all around the top of the casting. By making the core approximately 7 inches longer than the casting, it forms the inside of the runner. The core is then covered with a cake core as a whole or in halves, which leaves the space for the gate, and it is astonishing to see how rapidly it will take the metal through so small a space. I usually secure a pulley ring about 5 inches larger than the core, which gives me a basin 2½ inches in width. With the above method I always use a hot metal. I agree with the writer of the

article that the sand should not be close and well vented, and always use the regular floor sand which is not overburdened with strength.

The output of my foundry is about 50 tons of iron castings per week, and inasmuch as the sand must be imported from California, great economy must be exercised in its use. In making the liner mentioned it has been the practice to give the mold a thin coat of blacking and to skin dry the same. Should the casting require feeding, the riser is covered with a core, and after the mold is up, the core is removed, thus securing the benefit of the metal in the runner for feeding. As soon as the casting is set the runner is pried up, and by the adoption of this method the strain on the mold is greatly reduced. THOMAS SMITH.

BRASS LININGS FOR PUMPS.

Your article under "Brass Foundry Notes," by C. Vickers, concerning a brass lining for a pump and also previous articles in the December issue of THE FOUNDRY proved interesting to the writer, inasmuch as he recently had practically the same experience and difficulties in casting these brass cylinders. The problem, however, was solved by making a mold in dry sand in the usual manner and pouring on the top with one ladle. The mold was gated almost entirely around the cylinder. These molds have been made here very thin and as high as 36 inches and 24 inches in diameter. The only thing that was done which was not mentioned in this article was in the ramming of the core with considerable sawdust in the sand, so that it would be pretty soft, in order to allow for the shrinkage of the metal and to prevent splitting in cooling. We have made them ⅜ and ½-inch and they turned up perfectly clean. When the cylinder was very long, in order to hold the core, a 4-inch wrought iron pipe was screwed into an iron plate, which was used as a bottom board, and every foot or so a board was wedged to the pipe extending out to within an inch of the pattern to carry the weight of the core. I would not suggest, however, that an attempt be made to make a cylinder of this kind 3-16 inch thick of any great length on the first trial, as we believe it a pretty difficult piece of work to get the core and checks so that the mold will be perfect the first time. BY W.

IMPROVEMENTS IN INDUSTRIAL HYGIENE.

The past decade has witnessed a most remarkable advance in the improvement of working conditions for the operatives in manufacturing establishments. While the manufacturer has to a great extent voluntarily introduced such improvements, and has witnessed in their introduction an increase in the efficiency and longevity of his workers, the pressure of the law has in many cases been necessary to force him to meet the requirements.

Although the blower is very generally installed in connection with a heater as part of a mechanical system of ventilation and heating, local application as is usually necessary where the vitiation is excessive, in the metal working trades, for instance, the fan finds a broad field of application.

In the brass foundry hoods may be introduced over the brass furnaces, and and ventilation secured with certainty by the introduction of an exhaust fan. Rattling and tumbling barrels may be rendered innocuous by exhausting through hollow trunnions or from housings built over the tumblers. An exhaust system in connection with the sand blasting room will greatly improve the conditions under which the workman operates.

Probably the greatest need of exhaust ventilation in the metal industry exists in connection with buffing, grinding and polishing processes. The high speed of rotation of the wheel tends to throw the fine particles of dust directly into the atmosphere which soon becomes surcharged. Each wheel is usually enclosed in an individual hood rigidly supported and connecting through an exhaust pipe to a horizontal main laid just behind the grinders and thence to the fan. Each connection is provided with a blast gate.

The fan speed required for an exhausting system depends largely upon the material to be removed. When properly applied a vacuum of from one to

one and a half ounces is sufficient with a proper system of hooding to handle all dust in installations such as are here presented. If, however, the wheels are not properly hooded or the system not properly laid out, even a four-ounce vacuum may hardly prove sufficient to give satisfactory results.

BRITISH NOTES.

The reports of membership in connection with the British Foundrymen's Association are in the highest degree cheerful. The branches are increasing, especially the Birmingham Branch, which now numbers fifty members. Each meeting shows a steady improvement. One of the most interesting events in connection with the branch was a visit to the Mond Gas Plant, Dudley Port, on Monday, February 2, when about 40 members availed themselves of the invitation of the directors, R. Buchanan being in charge of the party. There were several interesting features, among them being Ferys' thermo-electric telescope pyrometer, very valuable for testing high temperatures. Other specialties exhibited were a heating apparatus for works and offices, core stove, japanning stove, etc.

Several interesting personal changes have taken place lately. The firm of Bayliss, Jones & Bayliss, of Wolverhampton, have recently been changing their heads of departments. Mr. Whitehouse, from Midwinter's, of Cumberland street, Birmingham, has gone to be foreman there, and Mr. Wood, lately in the employ of Messrs. Smith, of Wolverhampton, has succeeded Mr. Whitehouse at Midwinter's. The vacancy at Wolverhampton, now filled by Mr. Whitehouse, was caused by the death of J. Morris. The number of advertisements for qualified foundry managers with technical knowledge is rapidly increasing, and is considered a happy sign of the times.

Sir J. F. Flannery, presiding at the meeting of Henry Pooley & Sons, Birmingham, on Feb. 19, mentioned that the firm was about to have a new foundry, equipped with all the latest labor-saving appliances.

BRASS FOUNDRY NOTES

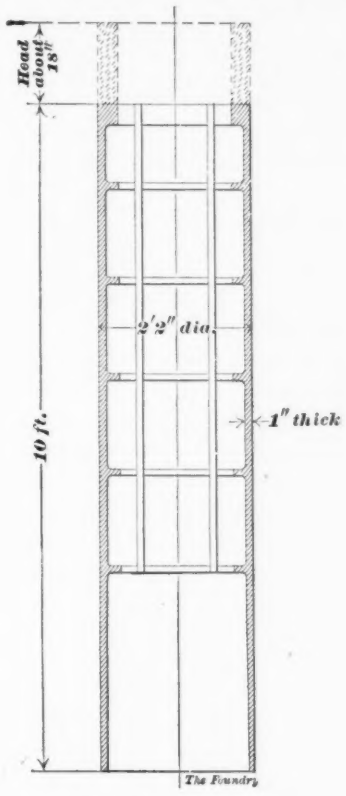
By C. Vickers.

Question:—We are having some trouble with gun metal liners, a section through the center of one of them being shown in the accompanying illustration. The casting is about 10 feet long, has a diameter of 26 inches, is plain on the outside, and has initial flanges and longitudinal ribs. The mixture that I have been using consists of copper, 88; tin, 12; yellow brass, 3.75. The yellow brass is made of copper, 2, and spelter 1, of new material. The copper consists of clippings, tin is extra fine and comes in ingots of a well-known English brand, guaranteed 99.5 per cent. The tensile test requirements are as follows: not less than 14 tons breaking, and not less than 7½ per cent elongation in 2 inches on test piece, 0.53 inches diameter. Water pressure test, 500 pounds per square inch. We cast from refined metal and melt in 400-pound crucibles, and pour into large ladles well warmed. We stir well two or three times, skim and pour. We cast from the top into a well which is kept full of metal until the casting is completed. The weight of the casting is about 4,600 pounds. This is a loam job, with a loam core, and all sorts of dressings have been tried on the mold, such as plumbago, china clay, geolite, etc. We cast vertically as sketched. We use fine coke dust for covering the surface of the metal in crucibles during melting to prevent oxidation. We would like to have suggestions as to how the above mixtures should be made. We melt the copper first, then add the tin, and last of all put in the yellow brass which has been refined and is in ingot form. When the casting is machined on the outside it is blotched with hard white patches, varying in size from ¼ to ¾-inch. These tear out at the point of the tool, giving the castings a porous appearance causing it to be rejected.

Answer:—The hard white spots are known as "tin spots," and are caused by the liquation of the alloy, a phenomenon well known to chemists and metallur-

gists, but not so well known in the foundry. The following quoted from the foot notes to *"Mendeluff's Principles of Chemistry"* is to the point:

"The alloy Sn Cu_5 is brittle, of a bluish color, and has nothing in common with either copper or tin in its appearance or properties. It remains perfectly homogeneous on cooling and acquires a crystalline structure. All these signs clearly



GUN METAL LINER.

indicate that the alloy Sn Cu_5 is a product of chemical combination, which is also seen to be the case from its density, 8.91. Had there been no contraction, the density of the alloy would have been 8.91. It is the heaviest of all the alloys of tin and copper because the density of tin is 7.99, and of copper 8.8. The alloy Sn Cu_4 has similar properties. All the alloys, except Sn Cu_5, and Sn Cu_4, split up on cooling, a portion richer in copper solidifies first, (this phenomenon is termed the liquation of an alloy), but the above two alloys do not split up on cooling. In these, and many similar facts, we can clearly distinguish a chemical union between the metals forming an alloy."

Whenever a heavy casting is made this liquation, can be observed in the sprue. As it solidifies, a portion of the metal which appears to be the normal alloy, shrinks down and contracts away from the sand walls, surrounding the sprue, or pouring gate. The space thus left vacant, is then gradually filled with a liquid, which upon solidification we find to be a dense, hard, and brittle alloy, of a whitish color. This is the chemical alloy of copper and tin referred to in the quotation.

This phenomenon occurs with castings where the metal through lack of pressure has been allowed to shrink away from the walls of the mold, the vacated place is then filled, with the extended chemical alloy, which can be broken away with a hammer in many cases leaving beneath it, a slight depression in the casting, proving that it had contracted away from the walls of the mold.

The remedy is to apply more pressure to keep the metal in close contact with the walls of the mold. The cold mold then chills the metal and solidification takes place, a shell forms, then, when the casting contracts away from the mold, as all castings do, at a certain point of solidification, liquation of the alloy is impossible through the shell of normal solid metal. But, when the casting is permitted to shrink away, from the mold before solidification *this point,* through the absence of the chilling action of the cold sand, remains in a plastic condition, after the rest of the casting is shelled over and the "eutectic" is extended into the vacancy.

From this reasoning, therefore, the liner casting in question should not show any tin spots on its lower portion, when the pressure is sufficiently great to keep the metal in close contact with the walls of the mold.

At the same time, we must bear in mind, that the casting being made in a dry and probably warm loam mold, there is not the chilling action there would be from a green sand surface. It is probable therefore that the casting sets uniformly, that a shell of solid metal

does not form against the walls of the mold, but that the alloy remains in a semi-plastic condition until solidification has proceeded to the point where the "eutectic" separates and consequently may be found as the correspondent says, "blotched all over the surface of the casting."

There are two things that might prevent this trouble, one is to chill the surface of the casting, and the other to change the alloy. Frankly I do not see how the first mentioned remedy is possible, so the only alternative left, is to change the alloy, and practically our only choice is to use a phosphor bronze. There are two formulas, the first of which I think the most suitable: No. 1 copper, 90 pounds; tin, 8 pounds; phosphor tin, 2 pounds. No. 2 copper, 90 pounds; phosphor tin 10 pounds.

HEAVY BRASS SCRAP FOR LIGHT CASTINGS.

Question:—I have a large quantity of heavy brass scrap, such as bearing bushings, some with phosphorus and heavyweight tin. I would like to work it into light castings before purchasing more red brass scrap. I have trouble, however, in getting it to run fine enough for small castings. I do jobbing work and a large amount of electrical work, such as switch boards, trolley wheels and general electrical attachments.

Answer:—You must first sort the scrap, the phosphorus bronze should be separated from the ordinary hard bronze, because the latter can be used to advantage in making soft alloys suitable for light castings, for which purpose the phosphorus bronze is not so suitable as it runs too sharp, if poured hot, making small castings rough in places, while if poured at a proper temperature, to run smooth, such castings are often mis-run.

To determine which of the scrap is phosphor bronze is a difficult matter, but when melted the phosphorus shows itself, as the metal is very fluid and lively. You may have noticed when melting which pieces contain phosphorus. It will be safe to pick all similar scrap out, and any others you may think likely to contain phosphorus. You will have to use considerable judgment in sorting scrap, it is impossible to give directions on paper, experience being the only reliable teacher. We will suppose the scrap is sorted into phosphorus bronze, ordinary hard bronze and red brass. In the red brass bin place such scrap as valves, small castings, and all material you know is usually made of soft metals. This scrap can be used as it is, or mixed with new metals in any proportions your judgment dictates.

The ordinary hard bronze can be worked on the following lines: For trolley cars, and other overhead electrical equipment, use hard bronze scrap, 50 pounds; copper, 40 pounds; zinc, 10 pounds; lead, 1 pound. For a better alloy, use hard bronze scrap, 50 pounds; copper, 40 pounds; zinc, 5 pounds; lead, 2 pounds.

For trolley wheels, if your customers wish a hard bronze, use the phosphor scrap straight. If a soft wheel is desired, take phosphorus bronze scrap, 50 pounds, and copper, 50 pounds.

The only trouble in using scrap phosphor bronze in trolley wheels, is that such material is apt to be high in lead and trolley wheels should contain no lead as it favors arcing. I make trolley wheels of phosphorus hardened copper alone. In using such material as this heavy brass scrap, the point to be borne in mind is that it contains tin, which costs nearly 50 cents a pound; that it is in such a form that it can be readily used to make any quality of bronze if intelligently alloyed with copper, and that such scrap does not contain sufficient lead or zinc to be taken into consideration for ordinary work. In figuring our mixtures we can place the tin content of such scrap at 10 per cent.

Figuring on these lines the second formula given would contain, copper, 85 pounds; tin, 5 pounds; zinc, 5 pounds; lead, 2 pounds.

An analysis would in all probability show more tin, zinc and lead than given, but that would be immaterial for the purposes for which the alloy is to be used.

USE OF TIN FOIL.

Question:—I have a quantity of tin foil and would like to know if it would answer the purpose of tin for making brass. If not, what would be the result? I would also like to secure bronze such as is used for the seats of globe valves, ¾ to 2 inches, to withstand 125 pounds pressure. Kindly advise how to make such a bronze.

Answer:—Tin foil may be used in making ordinary red brass. It contains lead, but that does not hurt. We suppose you are making an "Ounce metal," which is made of one ounce each of tin, lead and zinc to 16 ounces of copper? In using tin foil, take about one and one-half ounces and decrease the lead one half, as for example, copper, 16 pounds; foil, 1½ pounds; lead, ½ pound; zinc, 1 pound.

If you have a large quantity of foil, and wish to use it more intelligently, first run it into ingots, then get an analysis, and you will know just how to use it.

For the seats of globe valves, use the following alloy: copper, 80 pounds; tin, 8 pounds; zinc, 4 pounds, and lead, 1 pound.

STIRRING BRASS WITHOUT BAD EFFECT.

Question.—Kindly inform me whether you know of any method of stirring molten brass without bad effect. Some foundries use iron rods and others wooden sticks. I have always recommended a green stick coated with black lead, but this recommendation has somehow miscarried in some foundries, the parties claiming that the stick gets charred under the black lead.

Answer.—The usual method of stirring molten brass is with the poker or a skim iron. I have never heard of any bad effect therefrom, although undoubtedly a small amount of iron is dissolved by the brass, but this is not sufficient to do any harm. This is proved by the fact that brass, so stirred, produces castings of the usual golden color, while brass containing iron makes unsightly black and rough castings. The amount of iron that is sufficient to produce this black color is not great. A couple of ten penny nails will do lots of mischief, therefore the amount of iron dissolved from the poker is so small as to be unimportant. Of course stirring can be carried to excess and the metal injured by the use of an iron bar as a stirrer. When it is desirable to avoid such accidents, the stirrer, if of iron, can be given some protective coating, such as fire clay, for instance, or better still, a plumbago stirrer should be used. In casting copper, greater care should be exercised in the use of iron stirrers than with brass. For this purpose the plumbago stirrer is the best. The idea of stirring with a green stick is to deoxidize the metal. This, however, is an operation requiring special skill for if the stirring is continued beyond the point where the metal has been deoxidized it reverts to its former condition, on account of occluded gases, so that it is necessary to take samples of the metal and note the shrinkage to determine when the stirring has proceeded far enough to deoxidize the metal. Most brass founders would find the use of a green stick for stirring so objectionable that it would soon be discontinued, as the gases from the burning wood cause the metal to boil so violently that it is spattered about and lost and is at the same time liable to burn the operator. The coating of black lead has no value as a protective covering to protect the stick from burning. Better discard these sticks and stir your brass in the old-fashioned way whenever you think it needs stirring.

The Modern Machinery & Engineering Co., Cleveland, has acquired the selling agency formerly conducted by W. E. Flanders, with offices at 309 Schofield building, Cleveland, and 933 Monadnock block, Chicago. This concern will act as selling agent for the Potter & Johnston Machine Co. and the Landis Tool Co. Thomas F. Ahern, M. E., who has been manager of the Chicago office for the past two years and who was formerly connected with the Pratt & Whitney Co., is treasurer of the new concern.

THE PATTERN SHOP

COLLAPSIBLE PATTERNS

Their Advantages and Possibilities—Molding a Surface Condenser

By H. J. McCaslin.

MOLDING a surface condenser, as shown in Figs. 1 and 2, affords an excellent example of the advantages and possibilities of collapsible patterns, as this manner of construction makes it possible to remove the body of the pattern from the mold in parts or sections. The adoption of the method when applied to similar patterns having a box section will prove its practicability. It also facilitates the handling and storing of pattern.

Surface condensers are made in various forms, frequently assuming large proportions, as the one illustrated and discussed in this article. This is one section of a condenser used in connection with a large quadruple expansion marine engine, and has a length and height of about 12 feet, and a shell width of about 44 inches.

The molding of a surface condenser pattern upon its side is not always considered practical, or accomplished with very good results, the objectionable features being the difficulty of securing or holding down the main or body core, which would be in one piece, and the tendency of the mold to strain, which would, of course, result in a distorted casting. Hence the collapsible pattern makes it possible to mold the pattern upon its end, which has proved very satisfactory. This method of molding also facilitates the core making, as the body core is

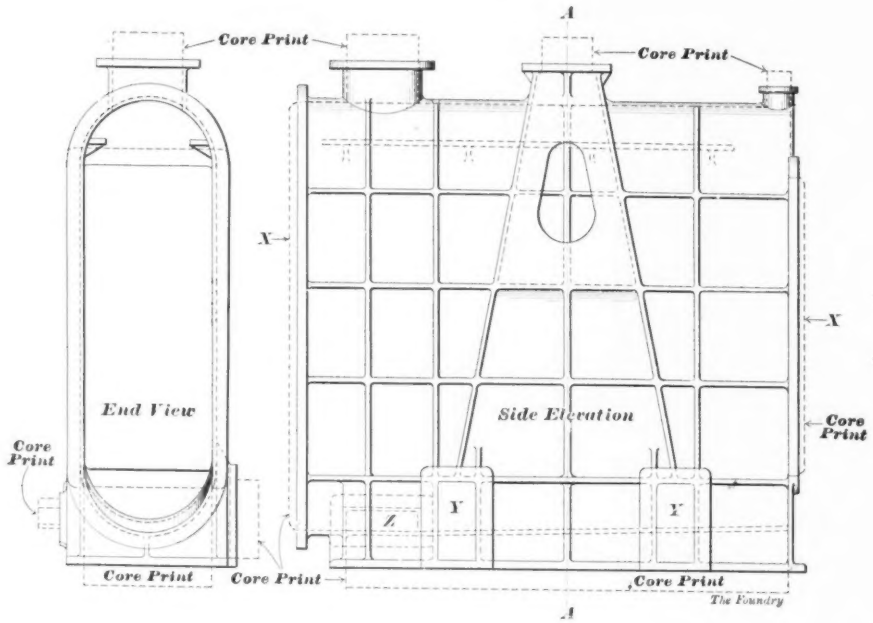


FIG. 1.—ASSEMBLED PATTERN.

made up in sections. These sections are piled or stacked upon each other during the assembling of the mold, as shown in the cross section of a complete mold, Fig. 11.

Form of the Casting.

Before proceeding with the construction of the pattern, let us study Figs. 1 and 2, and familiarize ourselves thoroughly with the interior and exterior form of the casting to be made. Fig. 1 gives a side and end elevation, showing the metal distribution, arrangement of botting flanges, column supports and method of cross ribbing. The metal thickness of the shell is about 1⅜ inches. It will be seen that the interior of the casting is of oblong form, as shown in the cross section Fig. 2, the bottom of which drops or pitches forward to the left that the water will drain toward the vacuum pump connection Z. The sides and one end of the shell extend below the bottom and form the support upon which the condenser rests. In this position it is bolted to the engine bed by the aid of the two rectangular flanges Y, as indicated in the side elevation.

If Figs. 1 and 2 represent the assembled and completed pattern in place of the casting, the core prints would appear at their respective locations as shown by dotted lines. As the tapered core prints X at each end of the pattern are used for the location of the body core only, their thickness need not exceed two inches. The remaining core prints should, however, provide a liberal bearing surface, from 8 to 12 inches for the setting and securing of their respective cores.

Construction of the Pattern.

A full size sectional plan, as shown in Fig. 2, is first required, together with the various connections, nozzles and column supports. A plan of the longitudinal section will not be found necessary, as any layout required can be made upon the pattern when the work has progressed to that stage of completion. To distinguish the layout of the nozzles and other connections, they should be dotted in with different colored crayons, and should be given a light coat of shellac.

The joint lines B B and C C of the four sections are determined as shown in Fig. 3. This part of the work should receive careful attention. Upon these lines, or in the plane of these lines, the four sections of the pattern are joined together, and the necessity of a good bearing between these surfaces will be readily appreciated. This illustration gives two end views of the assembled body, also the interior view of one of the sides, showing its general construction. While the method of collapsing the body of the pattern as shown in the two end views, Fig. 3, is self explanatory, a few suggestions should be made. In collapsing the pattern the separating pieces V and the cleats W, shown in dotted lines, having previously been removed, the two wedge sections, shown in Fig. 4, assisted by the tapered joints B B and C C, are drawn back into the interior of the body and lifted out, leaving the two sides free to be lifted out in a similar manner.

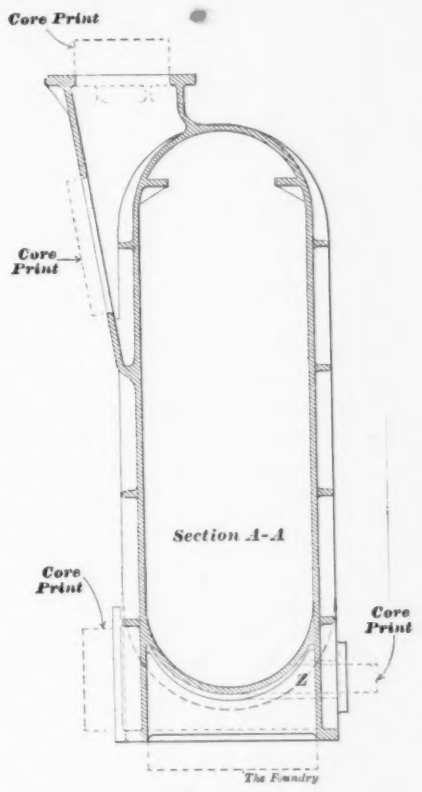


FIG. 2.—CONDENSER, CROSS-SECTION.

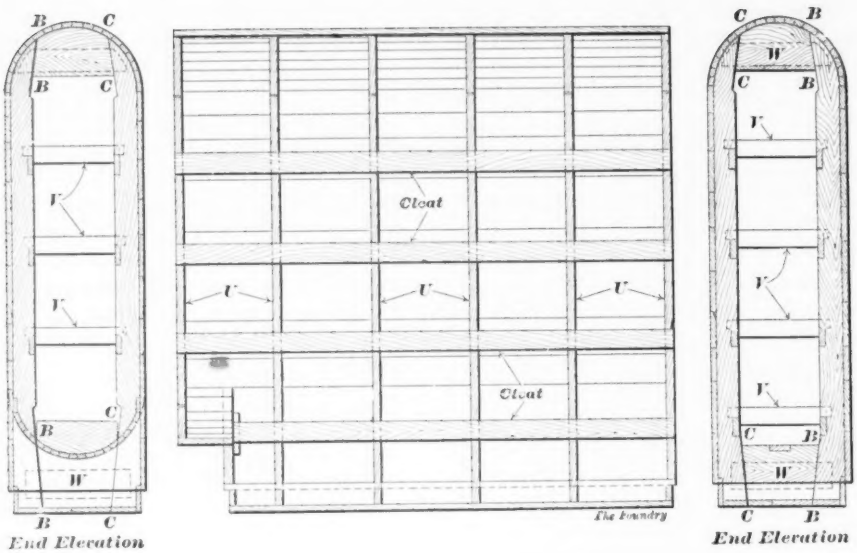


FIG. 3.—ARRANGEMENT OF STRINGERS.

Proceeding with the building of one side, Fig. 3, the six stringers U are made up to the exact dimensions, and substantially cleated together as shown. To insure uniformity of stringers, it will be found convenient to use a templet. The stringers having been properly placed, they are lagged and covered over with the closing-in material. It will be seen that one end of the body assumes an oblong shape for some distance back, and this can be taken care of somewhat after the manner shown.

The only way to make rapid progress on large patterns is to work strictly to the outline or dimensions, that is, do not allow any surplus material for dressing to size. Get out the heads or stringers to the exact form and size, line them up accurately, and allow for an exact thickness of closing-in material, which, when applied, requires very little, if any, dressing.

Body of the Pattern.

Fig. 4 shows the two wedge sections, which with the two side sections already described, form the body of the pattern. At the top of the figure are shown two views of the wedge section which forms that portion of the body, the construction simply consisting of lagging over six heads of the required form. At the bottom of the illustration is the wedge section which forms the bottom of the body.

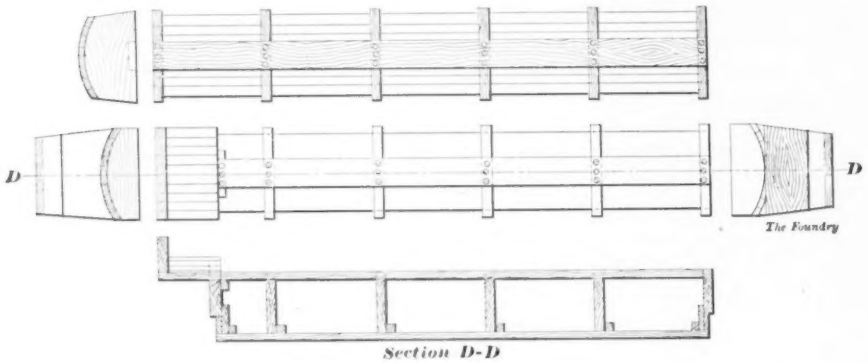


FIG. 4.—TWO-WEDGE SECTION.

This part requires a little more attention than the one shown above, as it is of irregular form, one end being so constructed or lagged as to conform to the sides, thus completing the lower circular portion of the oblong end of pattern.

The four sections of the pattern having been completed, their assembling is next considered. If these four parts have been made up carefully and accurately, well seasoned material being used in their construction, they should come together with very little or no fitting.

In commencing to assemble a true surface is very essential. One way of producing such a surface is to nail three strips upon the floor and dress them with a straight-edge free from wind. One of the side sections is now layed down upon this surface, the two wedge sections are next placed and fitted if necessary upon this side section, and temporarily braced in their respective positions. Should the remaining side fit correctly, the bracing of the four sections together from the interior of the body is proceeded with. Brace V and cleat W are used for this purpose, being located and secured in position with dowels and screws, or with bolts which are frequently used. The arrangement of the braces should be such that the dowel pins and screws are exposed from above, as this arrangement permits their successive removal downward from the top of the mold or pattern after lifting off the cope flask. Finding the location of pins or screws down in the dark interior of a pattern of this form is not always an easy matter without some manner of marking. A good practice is to encircle their location with black shellac.

As the facilities around most pattern shops for handling large patterns are not always the best, the usual practice is to complete one side of the work, then turn it over and proceed with the other side, or place the body in its upright position and proceed with both sides.

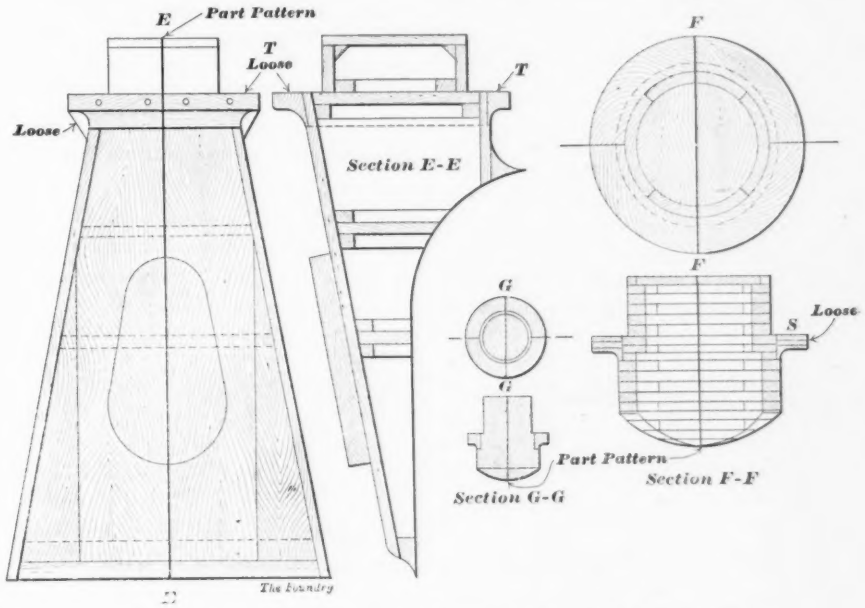


FIG. 5.—PLAN AND SECTION OF COLUMN SUPPORT AND NOZZLES.

Building Other Sections.

Following the assembling of the four parts as described, the upper surface of the work is given an application of coarse sand paper, and the center lines of all the ribs, nozzles and flanges are carefully laid off. These various parts are then built up. Fig. 5 gives plan and section of three of these parts. By studying their construction and referring to Figs. 1 and 2, a clear conception of their position

will be obtained. At the left of this figure is shown the column support which is parted on the line E E to facilitate molding. A convenient and accurate manner of constructing this part of the pattern is to lay off its outline in its correct position upon the body, then build it in place by getting out the material

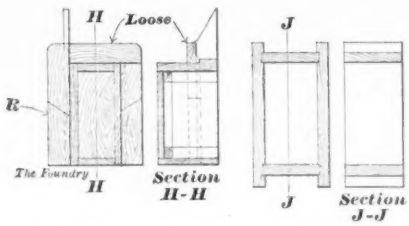


FIG. 6.—BOLTING FLANGES AND CORE BOX.

for the sides, and fitting it down to place, in which position it is temporarily secured. Next lay off the outline of sides and saw and dress them to form. It then becomes an easy operation to fit in the separating material, close in the ends and fill in the top somewhat after the manner illustrated, provision being made of course for the parting E E. The core prints being attached, provision is made for securing the loose flange T which is held in place with loose dowels.

The manner of securing the column support to the body of the pattern, or the method employed in securing all the separate parts, as ribs and nozzles to the body, is the same, loose pins being used from the outside, or screws inserted from the interior of the pattern. The loose pins used from the outside are removed as the ramming of the pattern progresses, while the screws are removed from the pattern interior at the completion of the ramming, as previously stated. It will be seen that this manner of attaching the various parts leaves them independent of each other, permitting their removal during the dismantling of the mold. At the right in Fig. 5 is shown a plan and section of the two nozzles with their respective core prints. The larger of these two pieces is built of segments and turned with its loose flange S to the required dimensions. The smaller nozzle can be of solid construction, but parted on the line A A.

Construction of the Bolting Flanges.

In Fig. 6 is shown a plan and section illustrating the arrangement and construction of one of the bolting flanges, as shown at Y, Fig. 1. Its construction simply consists of a box provided with an offset around three sides to receive the loose flange R. This arrangement allows the box portion to be drawn back, which permits the loose flange R to be drawn into the depression left vacant by it. At the right, Fig. 6, is shown the core box or frame used in making the

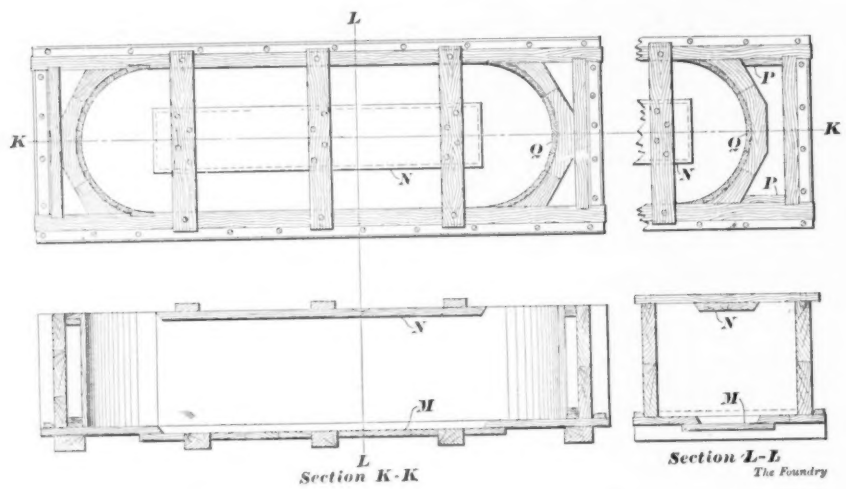


FIG. 7.—CORE BOX FOR OBLONG BODY CORE.

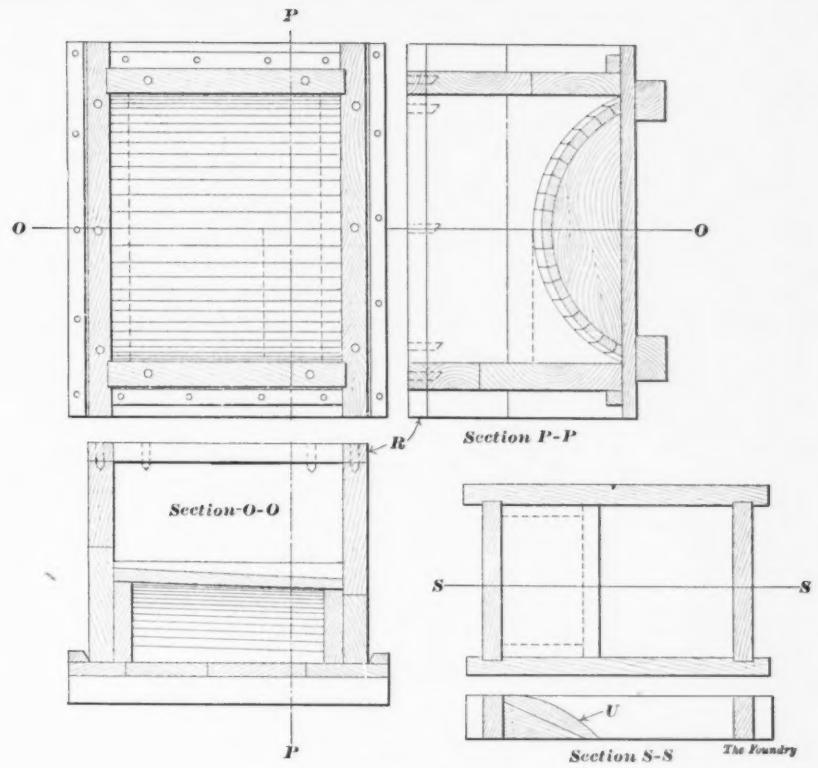


FIG. 8.—CORE BOX FOR CORES UNDER CONDENSER BOTTOM.

rectangular core which forms the depression enclosed by the flanges, shown in Figs. 1 and 2.

Fig. 7 shows the general construction and arrangement of the core box required in forming one section of the oblong body core, which is one of a series of cores which form the interior of the condenser.

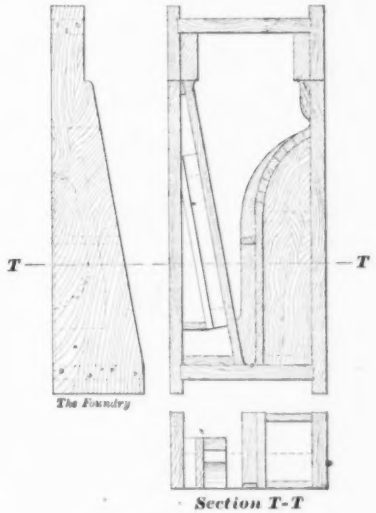


FIG. 9.—COLUMN SUPPORT CORE BOX.

Cores.

Owing to the pitch of the circular bottom of the condenser, each core must be

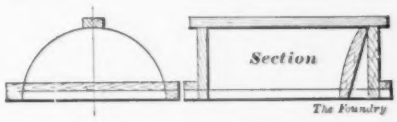


FIG. 10.—CORE FRAME FOR NOZZLE CORES.

of a different length. To provide for this variation the adjustable or sliding end Q which conforms to the required pitch of the bottom is employed. In adjusting the end Q, a number of pairs of distance pieces P are used, which are shown in position at the right in the illustration, in a part plan of the core box which shows the box set up for the shortest core required.

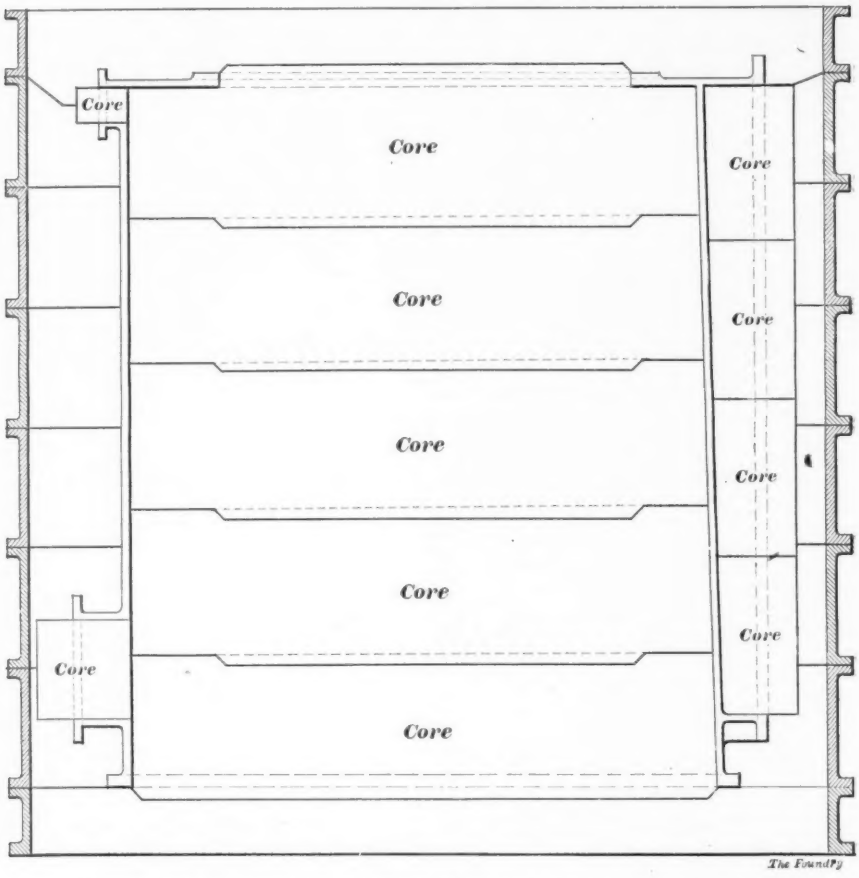


FIG. 10.—LONGITUDINAL SECTION THROUGH COMPLETED MOLD.

To insure the lining up and locking of the cores, a male and female joint is formed upon their upper and lower surfaces. A rectangular projection is formed by the depression M at the bottom of the box, while a corresponding depression is made by the material N suspended from the top of the box. In making the drag or cope cores, which receive a core print setting or a close over of the cope, the projection formed upon the core by the depression M in the bottom of the box, or the depression formed by the material N at the top of the box not being required, but upon one surface of these two cores, they are made without them, by simply filling in the depression M or removing the material N. As one of these two cores receives a core print setting, and the other a close over of the cope, the face of one core must conform to the taper of the drag core print, and the other to that of the cope. As no provision is made for this taper in the core box, it must be filed or rubbed upon the core after drying.

The condenser opening on the end opposite to that one shown in Fig. 1, is rectangular in form and must be taken care of by the top core. The addition to the core is made by placing a frame of the required shape upon the top of the core box.

Illustrated in Fig. 8 is the core box used in making the cores required to form that portion of the condenser underneath the bottom. These cores must conform to the pitch of the bottom, as well as to its curved section, being piled or stacked upon one another, as in the case of the body cores previously discussed.

Having a core print setting, they do not require a lock joint, as the core print locates and secures them in their correct position in the mold.

To make the various widths of cores from the same box, frames R, which are equivalent to the difference in each core, are made and pinned upon the top of the core box as shown. In the right hand corner of Fig. 8 is the core box used in making the core for the vacuum pump connection, the construction of which is that of an open frame without a bottom board. The loose piece U is dropped in upon the plate when ramming up the core.

Core Box for Column Support.

Fig. 9 shows the column support core box, used in making one-half of the core which forms the interior of this part of the casting. By studying the cross section of the condenser, shown in Fig. 2, a clearer idea of the form of the core and of its box can be obtained. In making the core box, the two sides shown in elevation at the left are gotten out to the required outline and framed together. It now becomes necessary to place in the frame the material so formed that it will produce the desired outline of core. While the frame can be used for the two halves of the core, a right and left set of filling in material will be required.

For forming the nozzle cores, a core frame, shown in Fig. 110, is used and is placed at one end of the frame. Fig. 11 illustrates a longitudinal section through the completed mold, showing its general arrangement, and the manner of stacking and setting the cores.

TRADE PUBLICATIONS.

SILICON ALLOY.—J. W. Paxson Co., Philadelphia. Eight-page bulletin No. 16. Contains a description and price list of "Outerbridge" silicon alloy for softening, strengthening and cleaning cast iron. A paper describing this alloy was read before the Franklin Institute, Philadelphia, by A. E. Outerbridge Jr., and was reprinted in the January issue of THE FOUNDRY. Mr. Outerbridge has discovered that when silicon is alloyed in an electric furnace with iron in suitable proportions, then granulated, the powder, when added in small quantities in a ladle of molten cast iron, melts readily and the silicon diffuses throughout the molten mass, thereby changing the combined carbon in the iron to the graphitic form, thus greatly increasing the softness of the casting. In addition, this alloy is claimed to increase the strength and the ductility of the metal, at the same time cleaning it by its deoxidizing and desulphurizing influence.

MAGNESIUM.—C. W. Leavitt & Co., New York, 4-page pamphlet. Describes the deoxidation of brass and bronze alloys by the use of magnesium. It is suggested that for the complete deoxidation of a fusion of ordinary composition the addition of 50 grams of magnesium to about 220 pounds of metal is necessary. It is claimed that magnesium decreases to the minimum the amount of impurities remaining as oxides, and its presence improves to an extraordinary degree the quality of castings, as has been demonstrated by physical tests.

FERRO-SILICON.—The Roessler & Hasslacher Chemical Co., New York, 4-page pamphlet, which describes the use of 50, 75 and 90 per cent ferro-silicon. It is claimed that for foundry use it is possible to obtain without changing the charge of the cupola the required qualities of cast iron for the different castings and it is stated that it dissolves easily without consuming much heat. From tests made it has been shown that the addition of ferro-silicon in the ladle not only facilitates the machining of castings, but also increases their strength and ductility. For foundry purposes 75 per cent ferro-silicon is recommended. The application of this alloy in steel works is also described.

PNEUMATIC CRANES.—Curtis & Co. Mfg. Co., St. Louis. Eight-page folder describes the double and single I-beam traveling cranes with pendant hand chain on bridge and trolley manufactured by this company. It also contains a description of light bridge cranes, low headroom traveling cranes, and double I-beam trunnioned trolley with vertical hoist.

DISC GRINDERS.—Gardner Machine Co., Beloit, Wis., 8-page folder. The grinding of pump bonnets, automobile parts, centrifugal pump cases, brass castings for gear blanks, unannealed drop forgings, cast iron feed roll boxes and cast iron piston rings, on a No. 4 Gardner's improved disc grinder, is graphically shown. Reports of the time consumed in grinding are also included.

IRON CEMENT.—Smooth-On Mfg. Co., Jersey City, N. J., 6-page folder. Contains the copy of an address delivered by S. D. Tompkins, president of this company, before the Modern Science Club, Brooklyn, Jan. 29. It describes the repair of a scored Corliss engine cylinder with Smooth-On cement.

VERTICAL ENGINES.—The B. F. Sturtevant Co., Hyde Park, Mass., 8-page pamphlet. This is a revised edition of Bulletin No. 125 in this company's engineering series. It describes the line of vertical forced-lubrication enclosed engines which this concern manufactures in 18 different sizes, ranging from 5 x 5 to 12 x 10.

BRUSHES.—American Wire Brush Co., 25 Broad street, New York, 16-page catalog. A full line of wire brushes for foundry use is described. This line is known by the trade name of Minerva and is manufactured under the Pollmann patents. The brushes are distinguished by the manner in which the bristles are fastened and also by their metal seats. The wires are arranged either singly, in pairs, or in bundles, so as to be free to swivel in all directions, the holes of the brush body through which these wires pass and project being correspondingly large.

CONTROLLERS.—Electric Controller & Supply Co., Cleveland. Bulletin 107, 20 pages. Shows the full line of type G controllers described in the March issue of THE FOUNDRY. In addition to valuable instructions for ordering these machines, it contains a price list of the various types.

AIR COMPRESSORS.—Abenaque Machine Works, Westminster Station, Vt., 8-page pamphlet. Contains complete description of the gas or gasoline driven direct connected air compressor outfits manufactured by this company. They consist of a 12-horsepower engine which, it is claimed, will actually develop from 14 to 15 horsepower and an 8 x 8 compressor which will furnish 75 cubic feet of free air per minute.

THE FOUNDRY

PUBLISHED MONTHLY BY

THE PENTON PUBLISHING CO.

CLEVELAND

BUFFALO ..... 932 Ellicott Sq.
CHICAGO ..... 1362 Monadnock Blk.
CINCINNATI ..... 124 Government Place.
NEW YORK ..... 150 Nassau St.
PITTSBURG.....521 Park Bldg.
DULUTH.

Copyright, 1907, by Penton Publishing Co.

The subscription price of THE FOUNDRY is $1.00 a year to points in the United States, Canada and Mexico. To Great Britain: Eight Shillings. Single copies, 15 cents each.

Change of advertising copy must reach this office on the 10th inst. preceding date of publication.

The Cleveland News Company will supply the trade with THE FOUNDRY through the regular channels of the American News Co.

European Agents: The International News Company, Breams Building, Chancery Lane, London, E. C., England.

Practical articles pertaining to the trade in all its branches are solicited and will be paid for.

When sending articles be sure to place your name and address on the article and on the drawings.

Entered as second-class matter at the Post-Office at Cleveland, Ohio.

PRINTED IN AN OPEN SHOP.

CONTENTS.

Metallography Applied to Foundry Work..	79
Electric Smelting	82
Malleable Furnace Bung.....	83
Profit Sharing Plan.....	83
Jobbing Foundry Cost System.....	84
Connellsville Coke Supply.....	89
Molding a Double Flange Pulley.....	90
Science in the Foundry.....	91
Cast Iron Notes.....	94
Thin Castings with Hard Cores.....	96
Rapid Determination of Carbon in Iron and Steel	96
Hot Shot	97
Length of Chords.....	99
Technical Foundry Education.....	99
New Plant of the Detroit Steel Casting Co.	100
Points for Brass Founders.....	108
Alloys of Aluminum and Copper.....	110
Casting Liners and Pump Plungers.....	110
Brass Liners for Pumps.....	111
Improvements in Industrial Hygiene.....	111
British Notes	112
Brass Foundry Notes.....	112
Collapsible Patterns	116
Trade Publications	123
Trade Outlook	124
Personal	125
Obituary	126
A. F. A. Convention.....	128
Associations and Societies.....	130
Sectional Core Oven.....	137
Automatic Drill Grinder.....	137
Ruddy Process for Locating Patterns.....	138
Sand Blast	139
Water-Cooled Gagger Mold.....	140
A New Metal Cleaner.....	140
Slitter and Disc Grinder.....	140
Trade Notes	141
Improved Band Saw	142
General Industrial Notes.....	143

Trade Outlook. Notwithstanding the defensive attitude maintained by both producers and consumers of pig iron during the past month, the market gained strength and prices, with only slight recessions, advanced from nominal quotations to actual values. Large interests in the west purchased southern iron freely for delivery over the entire year, while the leading cast iron maker secured 33,000 tons of No. 2 for the last half at $18 Birmingham. The buying from furnaces bordering the great lakes has been extremely limited but as their output is practically sold through the last quarter, they have displayed no disposition to force their iron on the market. The scarcity of basic iron is pronounced and steel casting manufacturers are increasing their percentage of scrap. Heavy melting stock has been shipped from Ohio and Indiana points to consumers on the eastern seaport, while the Pittsburg district has been heavily drawn upon for all available material. At Chicago, Lake Superior charcoal has been selling at $27 and northern grades of No. 2 foundry at $25.50 to $26 for prompt delivery. In the Cleveland district quotations have been maintained on practically the same basis, while furnaces in the Mahoning and Shenango valleys have been quoting $25.50 to $24 for April shipments. Foundries producing acid castings have experienced great difficulty in securing a low phosphorus iron and scrap, and concerns in Milwaukee and St. Louis are melting foreign pig. A slight falling off in the demand for gray iron castings has been experienced by the jobbing shops throughout the country, but the relief from the high pressure at which they have been operating is rather welcome. The output of malleable castings is still inadequate to the demand, the requirements of the implement makers being almost insatiate. Steel foundries report heavy tonnages from the railroads and car makers, notwithstanding recent raids which threatened disruption to certain financial centers. The steel casting plants in

the St. Louis district which produce practically one-third of the country's total, are unable to accept orders for delivery before July, one contract for 23,000 tons of bolsters having recently been awarded three of these plants. Brass foundries have again been compelled to readjust their costs on account of high prices of copper, tin, lead and zinc, and aluminum continues its upward movement and is scarce at the high values which are prevailing. The growing use of this metal in the manufacture of automobiles has crowded the makers to the limit, and the consumption requirements greatly exceed the production. Many brass foundries are installing aluminum furnaces, as these shops are well equipped for this practice, while a few plants are being fitted solely for the manufacture of these castings.

Foundry Cost Accounting

No problem has been as difficult of solution in the foundry trade as the proper method of cost accounting. Of the many systems pursued, none has yet been evolved which approximates a standard, and the various methods, particularly in the jobbing shops, have been disastrous in their ultimate results. It is fair to assume that the larger plants, representing heavy investments, are in position to closely figure their cost of production, but the repeated loss of orders estimated at a close margin is indicative of the gross ignorance of this essential feature in many foundries. Praiseworthy efforts are being made by the recently organized Jobbing Founders' Association to secure the adoption of a uniform system of cost keeping in jobbing shops, which intends for its ultimate purpose a relief from the ruinous competition which all are now compelled to meet. A system has already been recommended by the cost committee of this organization, which, with a few minor changes, will undoubtedly be adopted. The large special shops operating on duplicate work, with few exceptions, have systems which satisfactorily answer their requirements, but the variety of work made in the jobbing foundries requires a cost method which can be readily applied to all classes of work. The labor in one of the largest plants in the country is apportioned in such detail that its cost on each pound of iron melted can be correctly estimated, and for a period of one year amounted to a trifle less than one cent per pound, or to be accurate, 99.26 cents per cwt.

PERSONAL.

Harry Scullin, president, has also assumed the management of the plant of the Scullin-Gallagher Iron & Steel Co., St. Louis, succeeding J. N. Maher, who resigned March 1. Mr. Maher will take charge of the new steel foundry which will be erected by the Curtis & Co. Mfg. Co. Its melting equipment will consist of two small converters.

John S. Ball, Muskegon, Mich., has been appointed superintendent of foundry for the Jeffrey Mfg. Co., Columbus, O. Mr. Ball has resigned his position as general manager of the Enterprise Foundry Co., Muskegon, Heights, Mich., but still retains the vice presidency.

W. A. Kiern, for seven years purchasing agent of the Mesta Machine Co., Pittsburg, but who resigned from that company some time ago, has taken charge of the Pittsburg office of Pilling & Crane, dealers in pig iron.

After five years of active service in building and equipping the plant of the Central Radiator Co., Lansdale, Pa., Robert K. Storey has resigned his position as general manager.

P. M. Riley, who resigned his position as superintendent of the foundry of the Illinois Steel Co., Joliet, Ill., to accept the position of general manager of the Armour Steel Co., with plants at Joliet and Matthews, Ind., was the recipient of a farewell banquet from the officers and heads of departments of the former company, Jan. 6.

Louis A. Carlisle has been made general manager of the Central Foundry Co.'s plant at Bessemer, Ala., succeeding the late T. O. Kelley.

Thomas H. McGechin has been appointed eastern sales manager of the United States Cast Iron Pipe & Foundry Co., with offices at 71 Broadway, New York.

W. D. Mallette, superintendent of the plant of the American Steel Foundries, Sharon, Pa., has resigned.

C. W. Lytle, superintendent of the Pittsburg plant of the American Steel Foundries Co., has been appointed Pittsburg district manager to succeed Harry Wright, recently elected president of the Ohio Steel Foundry Co., which will erect a new plant at Lima, O.

W. S. Morehouse recently resigned his position with the A. S. Cameron Steam Pump Works, East Twenty-third street, New York, to accept the position of works manager with the Green Fuel Economizer Co., Matteawan, N. Y., manufacturer of fuel economizers, air heaters, steel plate fans, blowers and exhausters. He is a graduate of the Worcester Polytechnic Institute, a member of the American Society of Mechanical Engineers and of the American Foundrymen's Association.

W. M. Carr, assistant to the president of the Commonwealth Steel Co., St. Louis, has resigned and will engage in foundry engineering, specializing in open-hearth steel casting practice. Headquarters have been established at 120 Liberty street, New York.

James W. McNoldy, formerly superintendent of the Chicago & Alton foundry, Bloomington, Ill., has accepted the position of superintendent of the foundry of the Frost Mfg. Co., Galesburg, Ill.

F. Remple has taken charge of the foundry of the Globe Iron Works, Dayton, O., succeeding W. Fischer, who died recently.

J. F. W. Bunsen has been appointed manager of the Charleston, S. C., office of Muralt & Co., engineers and contractors, New York. Mr. Bunsen will have charge of the various projects of this company in the southern states and will give particular attention to the large power plant which that company is now building for the United States government at the Charleston navy yard.

William Hassett, formerly assistant foreman of the foundry of the Olds Motor Works, Lansing, Mich., has accepted the position of foundry foreman with the John Thompson & Sons Mfg. Co., Beloit, Wis.

OBITUARY.

William C. McMillan, financier, manufacturer and one of Detroit's most prominent and influential citizens, died at his home in that city Feb. 21, following two months of serious illness from pneumonia and congestion of the lungs, which was complicated by an affection of the heart. Three crises were encountered in the course of Mr. McMillan's illness, but his wonderful physical endurance and

WILLIAM C. MCMILLAN.

vitality enabled him to surmount two of these relapses. The third and fatal attack was accompanied by a weakness of the heart and the inevitable followed. In the death of Mr. McMillan the city of Detroit loses one of its most substantial citizens, and the industrial world a prominent figure. In the iron and steel manufacturing line he was a well-known personage. At the time of his death he was president of the Michigan Malleable Iron Co., the Detroit Seamless Steel Tube Co., the Monarch Steel Castings Co., and the Detroit Shipbuilding Co.; secretary of the Detroit Iron Furnace Co., and director of the American Shipbuilding Co. His varied business interests extended into many other lines of

industry, but he was especially a leading factor in lake navigation service. One of his notable achievements was the organization of the Detroit & Buffalo Navigation system. He assisted materially in giving the great lakes the finest passenger service of his time. His steamship interests made him president and general manager of the Detroit & Cleveland Navigation Co., and the Detroit & Buffalo Steam Boat Co.; vice president of the Duluth & Atlantic Transportation Co., director of the Michigan Steamship Co., and the Wolverine Steamship Co. His other lines of industrial effort included telephone companies, trust companies, banks, hotels, railroads, etc. Mr. McMillan was the eldest son of the late Senator McMillan, and was born in Detroit, March 1, 1861. After securing his education in the Detroit public schools and Yale University, he entered the employ of the Michigan Car Co., and in three years he had displayed such executive ability that he became general manager of the plant. He continued in this capacity until the Michigan Car Co. was consolidated with the Peninsular Car Co. in 1892, then as managing director of the Michigan-Peninsular Car Co. until it was absorbed by the American Car & Foundry Co. In 1898 Mr. McMillan and his father bought the controlling interest of the Michigan Malleable Iron Co., and he was made its president. Under his control the concern has been very largely extended. Later Mr. McMillan organized and secured the controlling interest in the Detroit Seamless Steel Tube Co. Four years ago he was suggested as a successor to his father in the United States senate, but declined to make the race. He was a candidate for this high office before the legislators of his state this year, but, handicapped by his illness, he was defeated. In politics Mr. McMillan was a dominant figure, and one of the leaders of his party in Michigan. The funeral services were held Feb. 23 from the family residence and the interment was made in the family vault at Elmwood cemetery.

James McKinney, senior partner of the firm of James McKinney & Son, operating the Albany Artchitectural Iron Works & Foundry, Albany, N. Y., died February 10, aged 82 years. He was born in Duanesburgh, N. Y., and early in his business career removed to New York city, where he was employed in different lines of the iron business. In 1850 he went to Albany and in 1857 formed, with Abram Mann, the foundry firm of McKinney & Mann. This copartnership was dissolved in 1867, and Mr. McKinney continued the business alone until 1884, when he took into partnership his son, Edward N. McKinney, and the firm became James McKinney & Son.

Harry C. Hoefinghoff, president and general manager of the Bickford Drill & Tool Co., Cincinnati, died March 2, of uremic poisoning. He was about 35 years of age and had been president of the Bickford Drill & Tool Co. since 1898. Through his aggressive and modern business methods the company had developed from a small concern into one of the largest manufacturers of radial drills in the country.

John R. Eakin, president of the Olive Stove Works, Beaver, Pa., died in that city Feb. 18, of paralysis, aged 78. Mr. Eakin was the first man to develop the coal industry at Enon, and for several years operated large mines there. He is survived by his wife and three children.

John M. Ryan, aged 43, died recently at his home in McKees Rocks, Pa. He organized and managed the Fort Pitt Malleable Iron Works, McKees Rocks.

NEW STEEL FOUNDRY.

The Keystone Steel Casting Co, has just been organized at Chester, Pa., and will shortly incorporate with a capital stock of $100,000. A plot of ground on the Philadelphia, Baltimore & Washington railroad, has been secured, on which it will build a plant for the manufacture of high grade light and medium weight crucible steel and McHaffie semisteel castings. Construction work will begin as soon as possible after the plans are completed, and the best equipment obtainable will be installed. Albert G. Lorenz is president and manager.

A. F. A. Convention

Bright Prospects for Extensive Display of Foundry Equipment and Supplies—Meeting of Associated Foundry Foremen

The exhibition of foundry and pattern shop supplies and equipment, which will be conducted in connection with the twelfth convention of the American Foundrymen's Association at Philadelphia May 21-24 already promises to surpass all previous efforts in this direction. The Foundry Supply Association, under whose auspices the show will be conducted, has made a remarkable gain in membership during the past 30 days, the enrollment now numbering about 70, and more than 40 of these manufacturers have already been allotted space in the Second Regiment armory, where the convention will be held. The displays will encompass all lines of foundry equipment and appliances, and many new machines will receive their first introduction to the trade at that time. Arrangements have been made with the Otto Gas Engine Co. of Philadelphia for the installation of a gas engine which will be used to operate a 45-kilowatt generator, which will be installed by the Crocker-Wheeler Co., Ampere, N. J.

The engine will be of the company's latest design, fitted with its patent electric igniter and rotary ball governor, which regulates the fuel consumption in accordance with the work accomplished All valves are mechanically operated. This company will show one or two of its smaller types of engines, as well as an Otto suction gas producer, from which it is claimed one horsepower can be obtained from one and one-half pounds of coal. Direct-current at 220 volts will be furnished the exhibitors requiring this power. The regular power current available, however, will be furnished by the Philadelphia Electric Co., and is alternating 220-volt, 60-cycle, 2-phase.

An air compressor will be installed, which will furnisn air at 80 pounds pressure for the operation of molding machines and other compressed air devices. The cost of piping the same to the various spaces will be prorated among the users. A waterproof tent, 84 x 150 feet, will be pitched in the lot adjoining the armory, as a protection to the outside exhibits. The tent exhibitors will have the advantage of an earth floor, which will permit them to dig suitable pits, build foundations, or carry on any other line of work in a manner similar to the procedure in an operative foundry. The only limitations as to banners or signs any of the exhibitors may display is that they must not extend over 12 feet from the floor. Satisfactory arrangements can be made through the secretary of the Foundry Supply Association for the delivery of freight to the armory and its return to the railroad station after having been properly boxed. The tent for the outside exhibits will be pitched several days before the armory is available and will be used as a receiving station until the convention hall is thrown open to the exhibitors.

A partial list of the exhibitors follows:

Arcade Mfg. Co., Freeport, Ill.
Berkshire Mfg. Co., Cleveland.
Bonvillain, Ph., & E. Ronceray, Paris, France.
Borgner & Co., Cyrus, Philadelphia.
Buffalo Forge Co., Buffalo.
Byram & Co., Detroit.
Cleveland Wire Spring Co., Cleveland.
Chicago Pneumatic Tool Co., Chicago.
Crocker-Wheeler Co., Ampere, N. J.
Detroit Foundry Supply Co., Detroit.
Dixon Crucible Co., Joseph, Jersey City.
Elliot, Debeoise & Anderson, New York.
Etting, E. J., Philadelphia.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Goldschmidt Thermit Co., New York.
Hanna Engineering Works, Chicago.
Herman Pneumatic Machine Co., Zelienople, Pa.
A. E. Hoermaun, M. E., New York.
Hill & Griffith Co., Cincinnati.
Interstate Sand Co., Cleveland.
Killing Molding Machine Co., Davenport, Ia.
Koppel Co., Arthur, New York.
Lindsay & Co., W. W., Philadelphia.

Link-Belt Co., Philadelphia.
McCormick Co., The J. S., Pittsburg.
Mitchell-Parks Mfg. Co., St. Louis.
Mumford Co., The E. H., Philadelphia.
Obermayer Co., The S., Cincinnati.
Osborn Mfg. Co., Cleveland.
Otto Gas Engine Works, Philadelphia.
Pangborn, The Thomas W. Co., New York.
Paxson Co., J. W., Philadelphia.
Penton Publishing Co., The, Cleveland.
Pridmore, Henry E., Chicago.
Robeson Process Co., Camden, N. J.
Rockwell Engineering Co., New York.
Rogers, Brown & Co., Cincinnati.
Seidel, Inc., R. B., Philadelphia.
Sly Mfg. Co., The W. W., Cleveland.
Smith Foundry Supply Co., The J. D., Cleveland.
Southern Machinery Co., Atlanta.
Standard Sand & Machine Co., Cleveland.
Tabor Mfg. Co., Philadelphia.
U. S. Graphite Co., Philadelphia.
Western Foundry Supply Co., East St. Louis, Ill.
Wilbraham-Green Blower Co., Philadelphia.
Whiting Foundry Equipment Co., The, Harvey, Ill.
Yale & Towne Mfg. Co., New York.

CONVENTION OF THE ASSOCIATED FOUNDRY FOREMEN.

The announcement notice of the fifth annual convention of the Associated Foundry Foremen has been issued by F. C. Everitt, secretary. This meeting, as in former years, will be held in connection with the convention of the American Foundrymen's Association, although the foremen will gather in Philadelphia on May 20. In addition to the invitation by the Philadelphia Foundrymen to the American Foundrymen's Association and affiliated organizations, the Philadelphia Foundry Foremen have extended the Associated Foremen a most cordial summons. Secretary Everitt states that some papers are still required to complete the program, and it is suggested that subjects be sent to Dr. Richard Moldenke, Watchung, N. J., as soon as possible.

The exhibits and meetings, as usual, will be open to all visitors, but the entertainment feature is to be limited to members, visiting ladies, and those guests who secure the proper credentials at the time of registration from Dr. Moldenke, who alone has been designated to pass on these matters. All others will be asked to contribute the sum of $5.00, which will fall considerably short of the actual cost. A list of the members of the Associated Foundry Foremen will be furnished the committee, and only those in good standing will be permitted to participate in the special entertainment unless the sum of $5.00 is paid. The secretary urges that each member attend promptly to the payment of all dues, and that the certificate of membership be carried to the convention. Visiting foundry foremen who desire to participate in the entertainment features and who are not members of the Associated Foundry Foremen are requested to apply to the secretary on or before May 15, and he will enroll them as members, the annual dues being only $2.00.

NATIONAL BRASS FOUNDERS' ASSOCIATION.

Charles J. Caley, New Britain, Conn., vice president of the American Foundrymen's Association and president of the brass section of this association, has directed letters to brass foundrymen, platers, rolling mill and supply interests and all others interested in the brass industry, soliciting their membership in the National Brass Founders' Association, which is to be organized during the convention of the American Foundrymen's Association, which will be held in Philadelphia May 21-24. It is probable that the meeting of those interested in the brass industry will be held Wednesday morning, May 22, although this has not yet been definitely decided.

SOCIAL HEADQUARTERS.

Dr. Richard Moldenke, secretary of the American Foundrymen's Association, announces that the Bellevue-Stratford has been chosen by the Philadelphia entertainment committee as the social headquarters for the May convention, in order to facilitate the making up of parties for the several trips contemplated. A list of hotels, together with rates, is also included. It is further stated that reduced railroad rates on the certificate plan are practically assured, western railroads alone awaiting definite action on 2-cent legislation before granting the application of the association.

ASSOCIATIONS AND SOCIETIES

"Methods of Keeping Foundry Costs" was discussed at the monthly meeting of the Pittsburg Foundrymen's Association, held at the Colonial Hotel Annex, Pittsburg, Monday, March 4. H. D. Miles, of the Buffalo Foundry Co., Buffalo, president of the recently organized Jobbing Founders' Association, presented the forms of a system which has been recommended for adoption and which, despite its simplicity, encompasses all of the cost details required by the ordinary jobbing foundry.

The first steps towards the formation of this association were taken about a year ago, and a permanent organization was effected in January. The enrollment now numbers 25, and the outlook is brighter for a rapid increase in membership. The varying methods of cost accounting in nearly all jobbing foundries which have resulted in a wide divergence of bids on all classes of work, and which often entail heavy losses to the successful bidder, was the incentive which led to this association. Its purpose is to establish a uniform system of cost keeping in all jobbing shops, which will ultimately result in a withdrawal of bids which result from an ignorance of actual costs of production.

The system provides for an order blank for the original work, copies of which are sent to the foundry, pattern shop, invoice and shipping clerks. The casting report form provides a space for the date of the heat, the numbers and weights of the good castings, as well as the defective, the contract number and a description of the section. Two daily time sheets were shown which provide for a record of the time expended on the work and the cost of the same. A more detailed time and cost sheet was also included on which is entered the time and cost of labor on each casting of the molder, handy molder, apprentice molder, core maker, handy core maker, apprentice core maker, helper, pit rammers and chippers. The cupola reports for each heat provided for the weights of the coke and lime, and the grades and weights of the iron. On the distribution sheet is entered the name of the customer and contract number, weight, tonnage expense, productive labor, productive labor expenses, direct expenses, freights, total cost, sales value and profit and loss.

The expense apportioned to tonnage was shown in another form and included the iron, which comprises the pig, scrap, coke for melting and the lime. It also contained the cupola labor, not including the foreman, cupola repairs, flasks, sand, facing, chaplets, yard labor, power for blowers, the total iron tonnage and the cost of the same per pound. Under the head of productive labor were included the molders, molders' helpers, molders and helpers on preparatory work, other direct labor such as making pits, ramming up, etc., core makers, chippers and cleaners. The expenses apportioned to productive labor included office and traveling expenses, salaries of officers, superintendent and foreman, pattern labor applied to the foundry, general labor, general supplies, power, heat and light, interest including that on the investment, taxes, insurance, and other expenses not specified.

A More Elaborate Plan.

J. F. Johnson, auditor of the Braddock Foundry & Machine Co., Braddock, Pa., a member of the cost committee of the Jobbing Founders' Association, presented a paper on the method in vogue in his plant, which was somewhat more elaborate than that given by Mr. Johnson.

Before explaining his foundry cost system he stated that although the shop was not engaged in jobbing work, an effort was made to carefully ascertain the cost of castings. The actual cost is ascertained at the end of each month and another average is secured at the end of the year, after the inventory has been made. A summation cost is also kept which deals alone with the wages of the men and which is handed to the foremen of the various departments at the end of

the month, so that they may know the actual cost of labor as compared with the output. In this way a careful check can be had on the variations in the cost of labor and the increase or the decrease of the output, and the plan serves to advise the department heads of their relative efficiency.

W. A. Bole, general manager of the Westinghouse Machine Co., East Pittsburg, Pa., briefly discussed the method of cost keeping in the foundry operated by his company. He said that his experience in the engine business proves conclusively that many builders of these machines do not know their cost of manufacture. The phenomenally low bids often offered showed this, and several of these manufacturers remained in business only as long as their capital held out. In purchasing material he stated that he has had the same experience, one concern underbidding another as much as 50 per cent on certain classes of work, while on other jobs the reverse would be true. He concluded that these manufacturers likewise had loose systems of computing their costs.

As there is a wide variation of work in the sections for engines, he added that there might be a tendency to pay too much attention to the costs of large castings, but to overcome this it is the intention in the near future to have two foundries, the one devoted to light and the other to heavy work, in charge of men who have specialized in these two distinct fields.

He said that on account of the large amount of duplicate work more attention is given to the method of molding, the arrangement of the pattern, the design of the flasks, etc., than would be possible in a jobbing shop where only a few sections might be cast from a pattern. Before proceeding with the making of the pattern the most economical and satisfactory method of molding is first decided, and after the pattern has been disposed of, the design of the flask is considered. Many of the flasks are faced on the joints, which arrangement, despite its expense, reduces the losses on large work to the minimum. As the molders in the Pittsburg district are strict adherents of the piece work system, and since it is difficult to reduce the time of molding a section, once it is established, every effort is made to establish the minimum the first time the pattern is placed in the sand. To facilitate the work the foreman is instructed to assist the molder in every way, that the first cost may be kept down to the proper basis, which will thereafter be established as the standard.

Mr. Bole then presented a table which clearly indicated the method of splitting up the foundry payroll and which showed the relative cost per cent of the various classes of wage labor. This covered the 12 months of 1906 and is exceedingly valuable for its detailed information. The table follows:

	Per cent.
Wages of molders	35.7
Wages of helpers	7.4
Coremaking	12.8
Melting, including all the labor engaged at the cupola and in the yard	3.2
Day and night labor	6.9
Chippers and cleaning castings	7.0
Miscellaneous labor	3.6
Shipping	1.5
Wages of men employed in the light and power departments	2.0
Wages of men engaged in renewals and repairs to power plant	0.3
Wages for repairs and renewals to foundry flasks	3.3
Wages for repairs and renewals to cranes.	0.6
Wages of foundry foremen and clerks	6.7
Wages of blacksmith and helper for bar iron work and work on chaplets, etc.	0.4
Wages of laborers	0.3
Wages of superintendent and clerks	4.0
Electric crane operators	3.7
Lavatory attendants and yard labor	0.6
Total	100.00

The cost of this labor for the year amounted to only 99.26 cents per cwt., or less than one cent per pound. He added that all molders are given helpers, as they have found it more economical to employ this cheaper grade of labor to cut sand and do other work on the floor than to take the time of the molders for this work.

The attendance was upwards of 100, and before the business session dinner was served.

Birmingham Branch of the British Foundrymen's Association.

A meeting of the Birmingham Branch of the British Foundrymen's Association was held at the Technical School, Saturday evening, Feb. 16. A paper was read by O. F. Hudson on "The microscopic testing of cast iron," which aroused much interest.

Mr. Hudson said that the object of the paper was to give some account of the structures commonly encountered in the microscopic examination of cast iron. It was most important that the preliminary work of preparing the specimen should be well and properly done. A small plane surface should be polished, free from scratches, and, if necessary, etched or stained by some suitable reagent. The best way to prepare was to saw a small piece from the metal to be examined, or to cut it by emery or carborundum wheel of the size of half inch, by three-eighths. It should be made perfectly plane by a smooth file, and edges should be beveled, the file marks to be finally removed with a fairly coarse emery paper. The microscopic examination was chiefly supplementary, but it was very important that full advantage should be taken of it. For polishing purposes, there should be emery paper of increasing degrees of fineness, and rouge, or alumina should be used though the latter was the better. A simple ignition of ammonia alum was sufficient for most purposes, and alumina might be used by dusting it on wet chamois leather. For etching purposes the agents used might be a dilution of two per cent of nitric acid, and ten per cent of picric solution in alcohol. Microscopic testing should enable them to recognize at a glance ferrite, cementite, pearlite, phosphide eutectic, and graphite.

The lecturer gave a detailed description of the appearances of the various elements, remarking that gray iron differed from white in having graphite as its characteristic constituent, and the character of iron depended largely upon the proportion of the two forms of carbon. The character of iron was determined principally by the form in which carbon occurred and this to a great extent was controlled by other impurities The rate of cooling also influenced the condition of carbon, but some white iron could not be made gray by slow cooling or vice versa. The paper was illustrated with a fine display of micrographs of castings showing how the mixtures of pig and the casting conditions and the rate of cooling might modify somewhat the previous structures.

The lecturer proceeded to give various examples of the manner of determining the character of the iron. Ferrite is the name given to carbonless iron. It is soft and not stained by the usual etching agents. If a piece of pure soft sheet iron were polished and suitably etched it would be seen on microscopical examination to be practically structureless, except for a net-work of fine black lines. It consisted entirely of crystals of ferrite, the fine black lines being the boundaries between crystals. Cementite is hard and brittle, and not stained by etching agents. Pearlite is an intimate mixture of ferrite and cementite distinguished under high powers by its fine banded structure. Phosphide eutectic is hard, and has the typical banded structure of eutectics. Graphite pure or almost pure of carbon, commonly occurred in the form of minute grains when it is known as temper carbon or temper graphite.

Iron with a small percentage of carbon, mild steel, showed after etching that it no longer consisted only of ferrite, but there were areas which had been darkened by the etching agents. Those dark areas showed a finely banded structure, and they were areas of pearlite, while the clear white ground mass was ferrite. On increasing the percentage of carbon, the amount of pearlite increased, and the ferrite decreased until a point was reached when the steel was seen to consist entirely of pearlite. This happened when the steel contained nine per cent of carbon. With further increase in the percentage of carbon the steel again was seen to be composed of two constituents, one dark pearlite, and one light. The light constituent unstained by the etching agents resembled at first sight ferrite, but on closer examination would be found to be exceedingly hard, and by suitable polishing would stand in

relief. This substance was cementite, and its amount increased as the percentage of carbon increased.

White cast iron consisted of pearlite, and cementite only and no marked boundary was discernible between the microstructure of white cast iron and very hard steel, just as there was no very sharp division in their other properties. Microscopically, white iron differed from very high carbon steel only in the relatively larger amount of cementite, and smaller amount of pearlite. It was thus seen that the pure iron and white iron were the extreme members of one continuous series of alloys, in so far as their microstructure was considered.

The chairman complimented Mr. Hudson on his excellent paper, and beautiful slides, the greater part of which, he said, were the lecturer's own, and he thought he was right in surmising that he was not the only one who liked Mr. Hudson's slides better than those he had borrowed. He thought they were very beautiful and showed up to advantage this branch of science. A great amount of work had been done on this subject. It seemed to him that there was another trade springing up, almost unnoticed, which would be a serious rival to their trade, namely the production of steel castings in place of iron castings. The production of steel castings at the present time was increasing enormously, and some firms in this town who had been using either metal or cast iron, were now directing their attention to steel castings to take their place. He was not an iron molder, or an iron caster, and he did not profess to give advice as to how to go to work, but there was an old saying that the outsider saw the most of the game, and he thought they were in such close contact with their work that it might prevent them taking a proper view of what was taking place. It seemed to him that the iron molder and the steel molder were different; what the difference was it would take a practical man to tell, but there was a difference. The iron molder did not appear to be, what he should be in the steel works, to be able to transpose with steel castings, although the work was similar. He was saying this simply to endeavor to impress upon them the immense importance of studying the question closely, for possibly it would be of vital interest to their trade. It was not only an art, but a science as well. They might have art which required a little science, and sometimes science came in simply by itself, but when they came in contact with each other, it was necessary for them to have a fair knowledge of both. He strongly urged upon all that they should begin to give special attention to the scientific branch of the subject, which would greatly help them in showing those problems which were associated with iron and steel casting.

Mr. Wilkinson, (West Bromwich), said that the lecturer had mentioned that the phosphide eutectic was the last constituent to solidify, and asked what effect quick cooling would have on phosphorous and further, whether sulphur and manganese contrasted under the microscope.

Mr. Hudson in reply said that the structure generally would be smaller in quick cooling and the parts would be broken up more. Manganese by itself, he said, had no effect on the microstructure, except that it combined with the sulphur and manganese, sulphite might be detected by the microscope. It was fairly easy to distinguish, though somewhat the same color; manganese was light, but when combined with sulphur it was somewhat lighter.

Mr. Cook said that the paper had thrown considerable light on the subject and would be very helpful to members. Referring to some of the slides which had been shown he said that he should not have recognized some of the blotches as temper carbon; he would have expected to find something smaller, and he would like to know what denoted temper carbon—was it by size or by formation? He understood the lecturer to say that temper carbon was in cast iron, he had always thought it impossible to get it in cast iron without annealing, as in malleable iron. He had had tensile bars up to eighteen tons, and thought he should have found some, but on magnifying up to 2,000 it was found that the shape of carbon was fluky and not sound, and he could find no temper carbon at all. He

asked for information as to whether it had actually been found in cast iron.

Mr. Hailstone thought that temper carbon was a very erroneous term to give to cast iron. He had examined five or six hundred specimens and had never found any temper carbon in them; he had always seen graphite as plates, but on the other hand, after annealing he had had no difficulty in seeing the temper carbon, which came out on the top of the cementite.

Mr. Hudson explained that temper carbon was the carbon separated from the iron during the annealing, and as two or three gentlemen had said they had never been able to find any temper carbon in cast iron it was rather difficult to say which was which, but so far as the effect on the properties of the iron were concerned it was a very small matter whether it was temper carbon or carbon. Because it had not been seen that did not necessarily prove that there was no temper carbon. It was an equally small carbon and just as small in cast iron. During the cooling process of cast iron, temper carbon might attach itself to the existing blocks of graphite, or be formed in their immediate neighborhood and so be hardly noticeable.

Mr. Mason asked the actual size of the pieces of iron used for magnifying. He agreed with the chairman that the iron trade could not stand still. If cast steel were coming to the front so much they must look ahead.

Mr. Wharton, on the principle that if silicon drove out carbon and sulphur retained it, thought that the character of iron might be very much altered in the different methods of molding. He asked how far blast would affect it. Speaking with reference to what the chairman had said concerning steel castings, Mr. Wharton said that he had worked in a steel foundry and his impressions were that the best molders in the steel works were those who had worked in iron. Men simply trained to the steel casting were "duffers" in iron work, but in the other case the men could go from one to the other according to requirements without any inconvenience.

Replying to Mr. Wharton's question, Mr. Cook said that the increase in sulphur caused by the higher blast was hardly perceptible. With a higher pressure the carbon got less.

Mr. Hudson remarked that the effect of remelting iron was to slightly increase the sulphur but to decrease the silicon.

The chairman wished to add a few words concerning the discussion on temper carbon. He said, "Do not call it temper carbon and then you will be all right." It was hard to say which was which, being in the form of a small worm, or a small starfish, or a blot of ink on the piece of paper, it really did not matter. There was only one carbon and it was the size that mattered; it was the size of the carbon which had to determine the strength of the section. When the large plates of graphite were split up into a number of plates it gave both the requisite strength.

General Prosperity of Philadelphia Foundries.—A. F. A. Headquarters.

An informal symposium on foundry trade conditions was an interesting feature of the monthly meeting of the Philadelphia Foundrymen's Association, which was held at the Manufacturers' Club on March 6. In view of the numerous reports that have appeared about the crest of the wave of prosperity having passed and the long feared decline having begun, Secretary Howard Evans asked the members what their experiences had been. The answers were unanimously satisfactory and showed conditions to be even better than have been generally stated.

Brief remarks were made by representatives of the Abram Cox Howe Co., Schaum & Uhlinger, the Bethlehem Steel Co., the United States Cast Iron Pipe & Foundry Co., the Camden Iron Works, the Enterprise Mfg. Co., William Sellers & Co., the Fairbanks Scale Co., the Dixon Crucible Co., and others, all of which showed that the foundry trade is in most excellent shape, with orders on hand that insure activity for many months to come. Concerns engaged exclusively in the manufacture of specialties reported that they had all the business

they could handle, and others engaged in a general foundry trade reported in many cases that they could not take any more orders.

The surprising statement was made by one manufacturer that his company was already negotiating for steel for the summer of 1908, a special grade being used. Vice president A. E. Outerbridge, who occupied the chair in the absence of President Devlin, speaking for Wm. Sellers & Co., said that it had been compelled to send work out and that it was far behind in its orders.

H. L. Haldeman, of the Pulaski Iron Co., and George C. Davies, of Pilling & Crane, speaking for the pig iron trade, said that they could see no signs of a let up in trade, that reports showed that foundries were full of work and that larger sales of iron had been made for the third and fourth quarters. It was generally agreed that the prospects all around were most flattering.

The entertainment committee reported that the Bellevue-Stratford Hotel had been selected as headquarters for the coming convention of the American Foundrymen's Association. The technical paper of the evening was presented by W. A. Pollock Davis on "Introduction of Nickel and Molybdenum in Foundry Practice." A lunch followed the meeting.

ANNUAL BANQUET.

The Cincinnati Foundry Foremen's Association gave its second annual banquet in the parlors of the Grand Hotel, Cincinnati, Saturday, March 23. The affair was largely attended and afforded an exceptional opportunity of effecting a reunion by social intercourse of those interested in foundry work and its highest achievements.

Toasts were responded to as follows: "Our Foundry Foremen's Association," H. J. Holmes; "Benefits to be Derived from Organization," Charles F. Waltz, secretary of the Employers' Association; "Immigrant Labor and Cincinnati Industrial Development," William F. Finch, secretary of the Cincinnati Industrial Bureau; "The Foundry Foreman," Chas. J. Goehringer; "Is a Chemist a Good Investment in a Foundry," C. H. Thomas.

ASSOCIATED FOREMEN OF PHILADELPHIA.

The twenty-sixth meeting of the Associated Foremen of Philadelphia and vicinity, was held at Philadelphia, March 11. The mixing of iron by chemical analysis and the advantages of this method over the cruder practice of mixing by fracture, was discussed.

The theater benefit, to raise funds for the entertainment of the visiting foremen who will attend the annual meeting of the Associated Foremen, and the Convention of the American Foundrymen's Association, May 21 to 24, will be given at the Grand Opera House, April 15 to 19.

Headquarters for the delegates who will attend the convention have already been secured, and will be announced later.

Cleveland Club Associated Patternmaker Foremen.

The joint paper which is to be presented at the Philadelphia convention of the American Foundrymen's Association was discussed at the monthly meeting of the Cleveland Club of Associated Patternmaker Foremen, Monday evening, March 11. The attendance was unusually large and it was one of the most enthusiastic meetings held by this organization. Several of the members furnished contributions which are to be embodied in this paper, and these were thoroughly discussed and many valuable suggestions were made. The matter presented was left in the hands of a committee which is to report at the next meeting, on Monday, April 8. The paper which the club presented at the A. F. A. convention last year on "Pattern Shop Equipment" was widely discussed, and judging from the work which is being done on the paper now in course of preparation, it will also be worthy of the same consideration.

Lancashire Branch of the British Foundrymen's Association.

At a well attended meeting of the Lancashire branch of the British Foundrymen's Association, held at the Municipal School of Technology, Manchester, England, March 2, a highly interesting and instructive paper was read by Prof. Carpenter, Ph. D., F. R. S. (Victoria University), entitled "The Vicissitudes of the Bessemer Process of Steelmaking." The paper was in the form of an abridged autobiography of the life of Bessemer, during the earlier stages of his career as an inventor, and contained a graphical account of the formidable difficulties and obstacles with which the great revolutionist was confronted in arriving at the results which he hoped would perfect his process, and also in introducing the product commercially.

The actual methods employed in the Bessemer process were explained at length and special reference was made to the apparatus used by the inventor in his experiments, which was compared with that in use at the present time. The speaker illustrated his remarks with a series of specially prepared lantern slides. At the conclusion of his address several questions were asked the speaker, which gave rise to considerable discussion among the members, reference being made to the business relationship which is claimed to have existed between Bessemer and Mushet. Remarks were made by C. C. Bransby and W. H. Sherburn, secretary and president of the association, respectively, after which a vote of thanks to Prof. Carpenter was proposed by R. W. Kenyon, of Accrington, which was duly seconded and carried unanimously. At the close of the meeting the committee expressed its gratification at the steady increase in membership and it was suggested that in the near future the association may approach the standard of efficiency attained by the American body which has accomplished such good work in elevating the iron and steel industries and crafts of that country.

The next meeting will be held on April 6, when a paper will be read on "Pig Iron Specifications and Samples, from a Maker's Point of View," by H. Pilkington, M. I. C. E., M. I. M. E. (president of the association).

SHORTAGE IN SHIPMENTS
Will Be Investigated by the New England Foundrymen's Association.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, March 13.

The shortage on shipments of pig iron and coke was brought up by one of the members and after considerable discussion on the subject it was voted that a committee of five be appointed to investigate and report back to the association on the matter of shipping conditions, particularly in regard to obtaining redress on shortage in shipment of pig iron and coke, the chair appointed the following:

J. L. Anthony, chairman, Weir Stove Co., Taunton, Mass.; Walter B. Snow, B. F. Sturtevant Co., Hyde Park, Mass.; Lewis E. Harper, Becker-Brainard Milling Mach. Co., Hyde Park, Mass.; Henry F. Arnold, American Tool & Machine Co., Hyde Park, Mass.; Wm. J. Breen, Hugh W. Adams & Son, Boston, Mass.

Announcement was made that the next meeting would be held in Boston on April 10, when Edwin A. Moore, president of the American Coke & Gas Consumption Co., Camden, N. J., will read a paper on "Bi-products, Coke, Etc."

After dinner had been served, Lewis E. Harper, superintendent of the Becker-Brainard Milling Machine Co., Hyde Park, Mass., gave a talk on "The Practical Operation of the Molding Machine," illustrated by stereopticon.

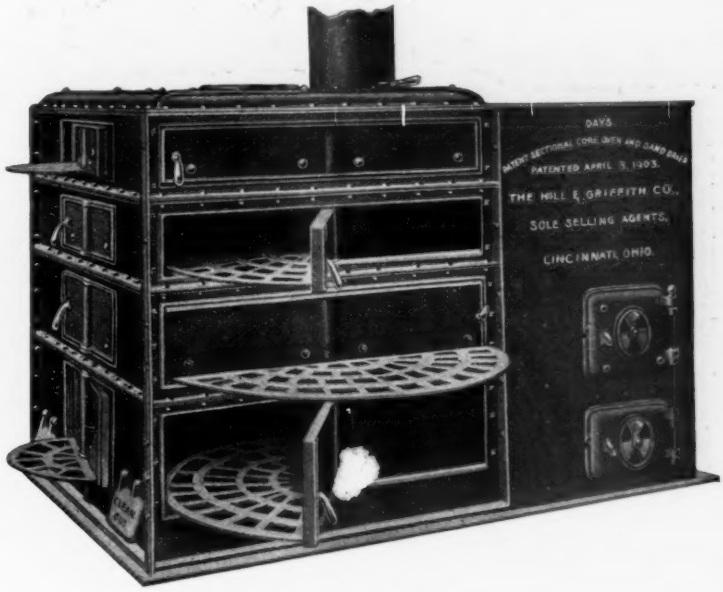
The Northern Engineering Works, Detroit, manufacturer of cranes, is building an addition to its plant consisting of an erecting building for electric crane trolleys, 50 x 100 feet one story in height, which will be served by a 10-ton, 3-motor electric traveling crane. A 2-story addition is also being built, which will serve as a tool room, and which will be approximately 30 x 50 feet. The buildings are of brick and steel construction and have saw-tooth roofs.

FOUNDRY AND PATTERN SHOP APPLIANCES AND SUPPLIES

Sectional Core Oven—Drill Grinder—Device for Locating Patterns—Sand Blast—Gagger Mold—Slitter—Band Saw

Trade Notes

The Hill & Griffith Co., Cincinnati, manufacturer of foundry facings, supplies and equipment, is offering Day's patent sectional core oven and sand drier, shown in the accompanying illustration. This oven is of the single type, having four sections, respectively 10 inches, 8 inches, and two 6 inches high. It also contains a bin for drying parting sand which can be constantly maintained in readiness for the molder. The oven is of cast iron and brick construction, no sheet steel being used. An even temperature is maintained throughout, and it is claimed that it is impossible to burn the cores on the bottom shelf unless those on the top are likewise burned. This single oven has twelve shelves on which cores can be placed and additional sections can be added to the four shown if required. One fire will accommodate an oven from six to ten sections high and provides space for from 18 to 30 shelves.

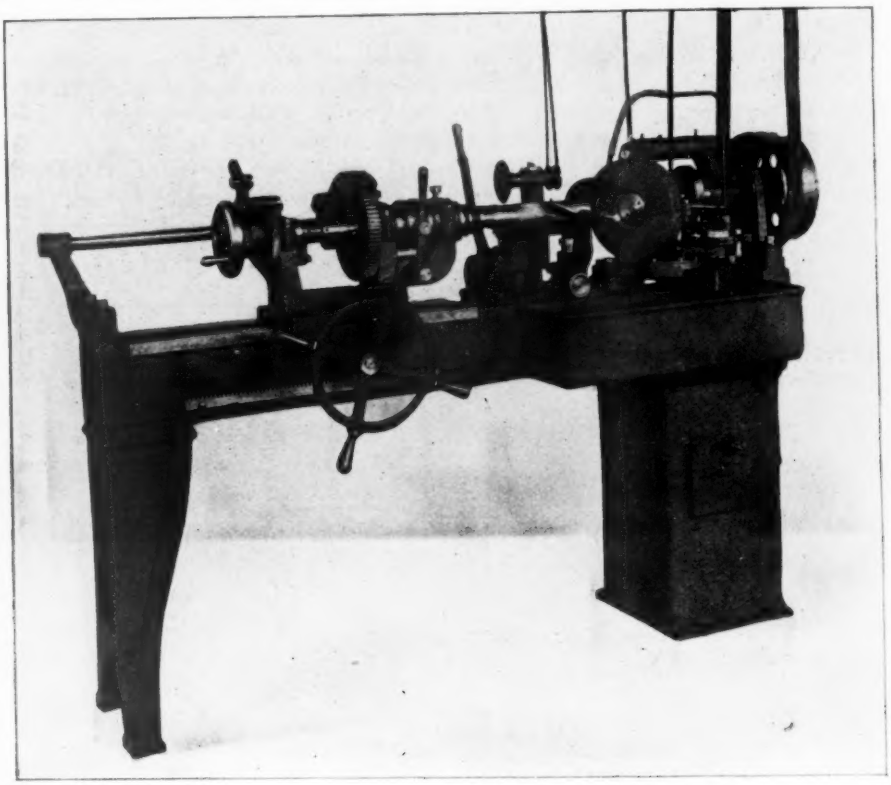


SECTIONAL CORE OVEN.

AUTOMATIC DRILL GRINDER.

The Dahl automatic drill grinder, herewith shown, is adapted for grinding drills ½ inch to 3½ inches in diameter, and operates automatically. It is equipped with a simple and rapid adjustment for taking care of drills of different sizes, an unskilled operator having no difficulty in grinding the drills at a true angle. No centering of the drills is required, as the grinding takes place while the drill is being revolved. After grinding they are pointed without being removed from the drill. The design of the machine insures equal height and even cutting on the lips of drills and the wear on the face of the

emery wheel is uniform, thus obviating the equalizing of the wheel. Gauges are provided on the head of the machine for adjusting the wheel for various diameters, and there is also a micrometer adjustment for the wheel to cover allowances for wear. It weighs approximately 1,900 pounds and is manufactured by Manning, Maxwell & Moore, New York.

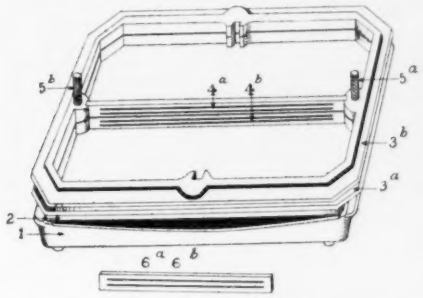


AUTOMATIC DRILL GRINDER.

RUDDY PROCESS FOR LOCATING PATTERNS ON MOLDING MACHINES.

To rapidly accomplish the location of split patterns on molding machines, Robert Ruddy, Mount Vernon, N. Y., has designed and patented the device herewith shown. It is claimed that no skilled labor is required and that an apprentice can locate three sets of patterns in a day. The placing of the pattern plate, 2, on a level work bench is the first operation, and after it has been oiled or greased thoroughly, frame, 3 a, is placed on the plate. The pins, 5 a and 5 b, are then inserted in the holes as indicated, and care should be taken that each pin passes through the pattern plate. When the pins are in position the frame is immovable. The dividing bar, 4 b, is then adjusted in the grooves in the center of the frame and one of the half patterns is located in one side of the frame in the required position. Plaster of Paris is then poured over this half pattern until it is covered about one-fourth, which means to a depth of plaster of ⅜ of an inch. Good plaster of Paris should set in 15 minutes. After the plaster has set either pin 5 a or 5 b is removed and the frame is moved either to the left or to the right, care being taken not to raise the frame. The other pin is then removed and the frame is slid off the plate. The frame is then turned over completely and laid on the tray shown at 1. The plaster of Paris and the patterns are then thoroughly oiled or greased on the flat side and the second frame 3 b is placed on the first

frame and is made secure by pins 5 a and 5 b through both frames. The dividing bar 4 a is then placed in the groove on top of the other bar. The other half of the pattern is then placed on the corresponding pattern and dowel pins are inserted to bring the patterns together accurately. Plaster of Paris is then poured in as before and after it is set either one of the pins 5 a or 5 b is removed and the dowel pins are taken out and the top frame is slid off the top. The other pin is then removed and the frame is lifted. The patterns are now ready to be placed on the molding machine plate, and this is accomplished by placing frame 3 a containing the first half pattern on the molding machine plate



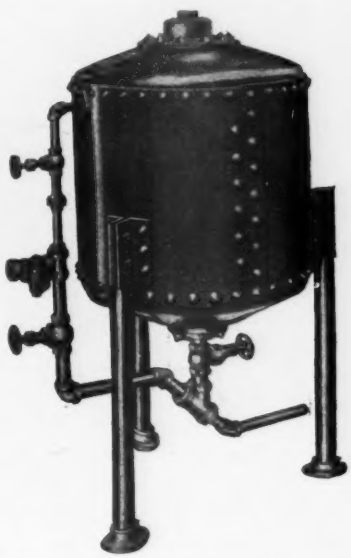
DEVICE FOR LOCATING PATTERNS.

and pins 5 a and 5 b inserted through the frame and plate. The pattern and plate are next drilled, a small drill press being suggested as the best method, and the pattern is next pinned to the plate. The plaster of Paris is then broken out and removed from the frame, which leaves the pattern on the molding machine plate. The same operation is adopted for locating the other half of the pattern plate of the molding machine. The gate can be located as required. The bars 6 a and 6 b are used instead of 4 a and 4 b in other grooves when the widths of patterns make their use a necessity.

John H. Wright, 608 Sixth avenue, New York, is the sole selling agent for the Ruddy pattern plate and process.

SAND BLAST.

The Farnham sand blast machine, which has been used for several years on exterior work for the cleaning of bridges, buildings, etc., is now being offered for use in foundries and machine shops by the Farnham Sand Blast Co., 41 Park Row, New York. These machines, as shown, are made in standard sizes of 500 and 1,000 pounds sand capacity, but can be built for larger capacity, if desired. Until a very recent date, these machines have been operating with a low pressure ranging from 15 to 30 pounds, with large nozzles having openings from 3/8 inch to 7/8 inch. As the ordinary shop compressor carries from 80



FARNHAM SAND BLAST MACHINE.

to 100 pounds it could not be economically used for this low pressure blast and it has been necessary to install an additional compressor. By the use of a small nozzle and a high pressure the amount of cubic feet of free air used by this blast is considerably less than the machines use with the low pressure, and it has been found that the blast is operated as economically by taking the air direct from the shop system as by using an extra compressor of the low pressure type. Although a smaller area is covered in a given time by the use of the small nozzle and the high pressure, nevertheless it is covered much more rapidly and the total time consumed for cleaning a

given area is the same for both high pressure and low pressure machines, although the high pressure type has the advantage of doing much better work. It is claimed that one of these machines will replace five men using wire brushes in the cleaning room.

WATER COOLED GAGGER MOLD.

The gagger mold shown in the accompanying illustration is designed for the rapid casting of gaggers at a minimum cost. The mold is water-jacketed and the constant circulation of water permits

WATER COOLED GAGGER MOLD.

of its continuous use. To supply water to the mold a hose is connected to the nipple attached to the trunnion, and another hose is attached to the trunnion on the opposite side, with a valve to regulate the amount of water to be carried away. This will provide sufficient circulation to maintain the board at an even temperature. If no water supply is at hand a barrel set up will answer the purpose equally as well. This entirely obviates the necessity of casting gaggers in the sand, and in addition, by the use of this mold, they are made absolutely clean and are ready for immediate use. The S. Obermayer Co., Cincinnati, is the selling agent.

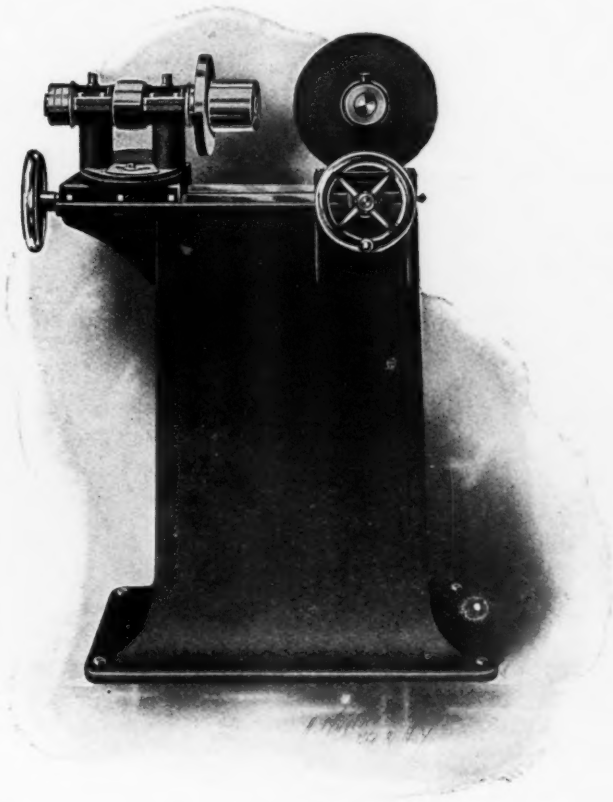
A NEW METAL CLEANER.

Fluxine, a new metal cleaner for brass foundry use, is being offered to the trade by the Foundry Specialty Co., Cincinnati. It is claimed that by its use a practically new and clean metal can be had from all kinds of scrap and that it will remove iron from brass and copper. It is further stated that it prevents oxidation, thereby reducing the percentage of loss in melting, reduces the oxides to a metallic state, produces a more homogeneous alloy, increases the tensile strength, melts the metal at a lower temperature, and does not attack the crucible. This cleaner is practically infusible and forms a dense cover over the bath, thus guarding it against all atmospheric influences.

SLITTER AND DISC GRINDER.

The slitter and disc grinder shown herewith, manufactured by the Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn., is made with a universal chuck for grinding punches, dies, and a large variety of flat faces or circular pieces. It has an expanding arbor which is opened and closed by means of a screw. Both heads swivel to an angle,

permitting convex, concave or flat faces to be rapidly ground. These heads are mounted on dovetailed ways, which are jibbed to take up wear and are fed by hand wheel and screw. This machine can be readily adapted, with minor changes, for grinding a large variety of work. The machine can be used for either wet or dry grinding, and when grinding wet, the wheel is enclosed by a hood and pans are arranged to catch the water which is conducted back into a large water tank in the base. The dirt and sediment settles to the bottom of the tank, while the clear water is drawn from above by means of a centrifugal pump, and in this way it is forced to the emery wheel and to the work that is being ground. The machine weighs 500 pounds complete and has the following dimensions: height from floor to center of spindle, 40 inches; length of bearings, 4 inches; diameter of spindle in bearings, 1½ inches; height from ways to center of spindle, 6 inches; diameter of face plate, 7 inches; size of wheel, 10 x 12 inches; driving pulley on head, 3½ x 2 inches; distance between platen and wheel when new, 6 inches.



SLITTER AND DISC GRINDER.

TRADE NOTES.

The Hill & Griffiths Co., Cincinnati, manufacturer of foundry supplies and equipment, has already prepared plans for the reconstruction of its plant, which was recently destroyed by fire. The facing mill and the warehouse will be located in two separate buildings divided by fire-walls. The warehouse will be three stories high and 80 x 72 feet in dimensions. The mill building will be 3½ stories high and 80 x 42 feet, and will contain 20 facing mills. Work on the erection of these buildings has already been commenced, and some of the mills will probably be placed in opera-

tion in April, although the entire plant will not be completed until June.

The firm of Dalton, Nash & Co. has been dissolved, F. A. Dalton retiring. The business will be continued at 82 Beaver street, New York, by the firm of Nash, Isham & Co., of which A. L. Nash and Phillips Isham will be partners.

The metallic manganese which is now being offered to the trade by Geo. G. Blackwell Sons & Co., Ltd., Liverpool, England, contains from 93 to 96 per cent of manganese, together with a small percentage of iron, carbon, silicon, etc.

The S. Obermayer Co., Cincinnati, manufacturer of foundry equipment and supplies, has awarded contracts for extensive additions to its Cincinnati plant on the west side of Evans street, south of Eighth. The improvements consist of a two-story brick building, 75 x 75 feet, which will be used for manufacturing purposes. A 500-horsepower Greenwald Corliss engine with a rope drive will be installed.

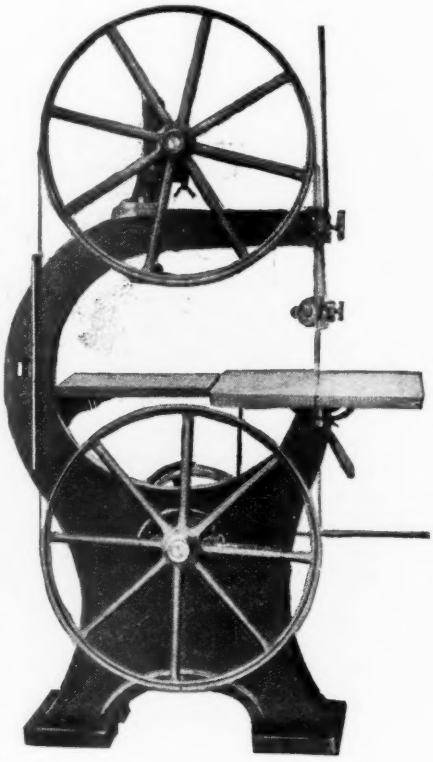
Wonham & Magor, New York, selling agents for the Whiting Foundry Equipment Co., recently secured an order from the Donaldson Iron Co., Emaus, Pa., for two Whiting cupolas, 84 inches in diameter and 60 feet high, including a special lining for the same. The order for the ladle equipment was also awarded this company.

At the annual meeting of the Dolan Sand Co., Coxsackie, N. Y., the number of directors was increased from four to six and the following officers were elected: Michael Dolan, president; Thos. W. Panghorn, vice president; J. M. Dolan, secretary and treasurer. Thos. W. Pangborn, who succeeded Henry C. Fischer as vice president, is general manager of the Thos. W. Pangborn Co., New York, which controls the sale of the products of the Dolan Sand Co.

The American Blower Co., Detroit, is erecting an addition to its steel plate fan shop, 105 x 75 feet, one story in height, with gallery. This extension will make the total length of this shop 250 feet. It will be equipped throughout with electric cranes and the latest machinery for the manufacture of fans. Two new locker rooms will be installed, each equipped with 100 lockers.

IMPROVED BAND SAW.

The 32-inch band saw, manufactured by the Crescent Machine Co., Leetonia, O., shown in the accompanying illustration, has been recently remodeled and improved. The frame is cast in one piece, is cored, and it has been given the proper distribution of metal



CRESCENT BAND SAW.

in all parts to give the machine the required rigidity so desirable in a band saw. The machine has box feet and a broad floor base which gives it a massive appearance. The table may be tilted to an angle of 45 degrees for bevel sawing and by drawing the hand lever the table is held rigid at any point. The table segments slide in machined ways and when the angle is being changed there is absolutely no side motion. The machine is equipped with a patent adjusting device for guiding the saw blade in any desired path on the face of the wheels and if desired, this adjustment can be made while the machine is in motion.

GENERAL INDUSTRIAL NOTES

The National Foundry Co., Erie, Pa., has completed its large modern foundry for the manufacture of open-hearth steel castings and recently made its first heat. The start was very successful and the management of the various departments is in the hands of men of wide experience, so that the success of this company in the manufacture of open-hearth steel castings of every description, as well as gray iron castings, seems assured.

The Texas Iron & Car Works, M. W. Carroll, proprietor, Beaumont, Texas, has purchased the old foundry and machine shop formerly owned and operated by the Kirby Lumber Co., and will remodel and equip it for the manufacture of logging cars. The foundry portion of the plant will be ready for operation as soon as additional machinery can be secured and installed, but the machine shop will not be operated at present.

On account of the death of Stephen Cheney, the foundry business heretofore conducted by Stephen Cheney & Son, Manlius, N. Y., has been incorporated under the name of Stephen Cheney & Son, to which the firm has transferred its property and business. Walter W. Cheney, the surviving partner of the firm, is largely interested in the new company, with which he will continue in the same capacity as when the business was conducted by the firm.

The Gould Coupler Co., Depew, N. Y., has just installed and started the fourth 20-ton open-hearth furnace in its steel plant, and has also installed the new equipment for the recently completed addition to its machine shop.

The Fox Machine Co., Grand Rapids, Mich., recently received an order for a No. 8 F Fox Universal wood trimmer, and four machines of the bench type. This company also recently secured an order from the Allis-Chalmers Co., Milwaukee, for 43 Fox trimmers, 12 of the Universal type, and 31 bench machines. The Stuyvesant High School, of New York, also recently purchased four Fox trimmers, three bench machines and one of the Universal type.

The Richmond Foundry & Mfg. Co., Inc., Richmond, Va., is now occupying its new works, erected for the manufacture of gray iron castings, stoves, scales and automatic machines. The site comprises 10 acres, thus providing for the enlargement of the plant, which now includes the following buildings: Steel foundry building, 80 x 320 feet, equipped with two Whiting cupolas, a Root blower and overhead trolleys; cleaning room, 80 x 80 feet; grinding room, 40 x 80 feet; storage room, 40 x 80 feet, and machine shop, 80 x 160 feet. A fireproof pattern vault adjoins the foundry, and a three-story warehouse, 80 x 160 feet, is built close to the machine shop.

The Trahern Pump Co., Rockford, Ill., manufacturer of iron and brass pumps, is erecting an addition to its foundry, 72 x 96 feet, the equipment for which has already been ordered.

The Ideal Mfg. Co., Detroit, manufacturer of soil pipe and fittings, as well as cast iron toys, has elected officers as follows: James W. Wright, president; James W. Dwyer, vice president and secretary; John H. Bissell, treasurer, and James P. Feely Jr., assistant secretary.

The Wytheville Foundry & Machine Shops, Wytheville, Va., recently incorporated, are equipping a modern foundry and machine shops. The capacity of the foundry will be five tons a day and a specialty will be made of small castings. The plant will be in operation by May 1.

A certificate of increase of capital stock from $1,000,000 to $1,500,000 has been filed with the secretary of state of New Jersey by the Commonwealth Steel Co., of St. Louis.

The Buffalo Pattern Works, Buffalo, has been organized with a capitalization of $20,000 by Edward Simon and Henry Walthers.

The Neosho Foundry & Plow Works, Neosho, Mo., has been organized with a capital of $150,000 by Warren Henton, J. C. Alexander, E. D. Smith and others.

New Construction.

The Bonny-Floyd Co., Columbus, O., recently incorporated with a capital stock of $100,000 to establish a plant for the manufacture of steel castings, has let the contract for the erection of its first building to the Pittsburg Bridge & Iron Works. This building will be entirely of steel, and will contain 8,000 square feet of molding space. It will be 106 x 132 feet at its widest point and 72 feet wide at its narrowest point. The company has purchased several acres on South Parsons avenue and expects to have its first building ready for operation by May 1. It will then commence turning out castings, and the other buildings will be completed during the summer. A specialty will be made of medium and small castings for use in cars, automobiles, etc.

The Samuel C. Tatum Co., Cincinnati, manufacturer of copying presses, printers' machinery, etc., is preparing to erect a new plant, the main building of which will be 366 feet in length, four stories and basement. There will be a foundry building, 110 x 300 feet, with separate power plant and pattern storage buildings. For nearly 50 years the company has been located at Water, John and Front streets. Its new location will be on Colerain avenue, in the western part of the city.

A contract calling for the completion of the work by Sept. 1 has been let by the Racquette Foundry & Machine Co., Potsdam, N. Y., for its new plant at Massena, N. Y. The buildings will be of brick and steel, and include a foundry, 53 x 99 feet, and machine shop 58 x 115 feet. When the plant is completed, the company will remove from Potsdam to Massena.

Brass and gray iron foundries have been planned as two of the constituents of the new shops which the Grand Trunk Railway will build at Battle Creek, Mich. The gray iron foundry will be 131 x 173 feet, and will be located close to the storehouse and locomotive shop, which will be the principal users of the product of this plant The foundry floor will be commanded by a 20-ton crane while an outside crane

of five tons capacity, running between the foundry and the power house will serve the charging floor. This crane will replace the usual elevator and will permit coke to be unloaded directly from the cars either into the coke bunkers or on to the charging platform. Pig iron will be delivered to the platform from any part of the yard and the slag will be transferred to the ash car near the power house. A system of narrow gage tracks and turntables in and about the foundry will supplement the cranes. The brass foundry, 30 x 72 feet, will be located in one side of the foundry building. It will be equipped with one or more furnaces and will be provided with a cleaning room 48 x 81 feet. This section of the building will be served by a 5 ton crane, which will also operate in the main part of the building, facilitating the transportation of castings to the cleaning room. This building will be a self-supporting steel structure, with brick walls and a cement roof. The output of the gray iron foundry will be 20 tons daily.

The Rock Island Tool Co., Rock Island, Ill., recently organized, has taken over the business of the Jacobson Machine Mfg. Co., Warren, Pa., and will manufacture a full line of vises and other tools. The company states that it expects to build next fall, but is at present occupying temporary foundry and machine shops and is in the market for foundry equipment, machine tools, electric motors and power plant equipment.

The Epping-Carpenter Co., Pittsburg, has acquired control of all the property from Forty-first street to Forty-third street, between the Allegheny Valley and the Pittsburg Junction railroads, affording the best of shipping facilities. To provide for its increasing business, the company has just erected and put in operation a foundry, 115 x 175 feet, equipped with modern improvements, and served by a 25-ton electric traveling crane. Other improvements include a pattern storage house, 60 x 85 feet, the enlargement of the patternmaking room, and an annex to the machine shop. A two-story steel addition, 72 x 104 feet, for use as an erecting shop, will be built on the property just purchased.

The Vermont Snath Co., Springfield, Vt., manufacturer of machinery castings, contemplates additions which will give 15,000 square feet of new floor space for molding, and a new cleaning department. The company expects to require for new equipment a new cupola, blowers, one or more electric cranes, a battery of tumbling mills for cleaning small castings, and probably a shop industrial railway. The power is undecided, but probably 150 horsepower will be required.

The Federal Brass & Bronze Co., 1133 Broadway, New York, has purchased seven lots in Astoria, L. I., near its present plant, for the manufacture of architectural brass and bronze work, and will erect a building about 75 x 125 feet.

The Stephens-Adamson Co., Aurora, Ill., has purchased land adjoining its present plant and will erect a foundry, costing between $25,000 and $35,000.

The Midvale Steel Co., Philadelphia, has taken out a permit for the erection of a large iron wheel house, 164 x 256 feet.

The George H. Smith Steel Castings Co., Milwaukee, will erect a foundry building, 120 x 160 feet, at a cost of $25,000, to replace the one destroyed by fire several weeks ago.

The Southern Skein & Foundry Co., Chattanooga, Tenn., will erect a plant for the manufacture of wagon skeins and other castings.

The Fulton Co., Knoxville Tenn., is planning extensive additions to its plant, including a brass and iron foundry.

Charles R. Evans, 33 Equitable building, Boston, has awarded the contract for a frame foundry addition, one story, 40 x 90 feet.

The Beaumont Iron Works, Beaumont, Texas, is planning the erection of a new brass foundry and an addition to its iron foundry.

The Indiana Foundry & Machine Co., South Bend, Ind., has let contracts for the reconstruction of its foundry buildings, which were destroyed by fire some time ago.

The Woods-Evertz Stove Co., Springfield, Mo., has purchased a lot, 130 x 320 feet, on which a new foundry building will be erected.

The American Hoist & Derrick Co., St. Paul, Minn., is planning to erect a new foundry building, 188 x 413 feet, at a cost of $100,000.

A new brick building, 60 x 160 feet, is under construction for the Sutton Foundry plant, New Orleans, La.

The Iowa Radiator Co., Cedar Rapids, Ia., is erecting a foundry, 80 x 100 feet; a machine shop, 50 x 200 feet, and a boiler room, 40 x 40 feet. The work is to be completed by June 15.

The El Paso Foundry & Machine Co., El Paso, Tex., has taken out building permits for the following buildings: Storehouse, 50 x 200 feet; boiler room, 85 x 230 feet; power house, 50 x 100 feet. About $20,000 will be expended in their construction.

B. B. Cohen, proprietor of the Sheffield Stove Foundry, which was destroyed by fire at Sheffield, Ala., about six months ago, has concluded an agreement with the Young Men's Commercial Club of Florence, Ala., for the establishment of a large stove foundry in Florence. Work on the new plant will soon be commenced.

The Berbecker & Rowland Mfg. Co., Waterbury, Conn., has let the contract for a two-story brick addition, 40 x 82 feet, to its brass foundry.

The Marion Machine, Foundry & Supply Co., Marion, Ind., will erect a new foundry building, 50 x 132 feet, of fireproof construction, which will be equipped with the latest improved machinery and appliances.

The Thayer Foundry Co., Atchison, Kas., is about to begin the erection of a new pattern shop and enlarge its machine shop. Improvements will soon be made to the foundry.

The Globe Malleable Iron Co., Syracuse, N. Y., has begun work on an addition, 80 x 160 feet, to its foundry. The building will be of reinforced concrete and is expected to be in operation by the middle of May.

O. L. Henault, 34 Napoleon road, St. Cunegonde, P. Q., Canada, will erect an open-hearth steel casting plant and will install one 10-ton basic open-hearth furnace which will give the plant an initial capacity of 30 tons daily. T. J. Best has been appointed general manager. W. M. Carr, 120 Liberty street, New York, is consulting engineer.

Two 5-Motor, 35-Ton, 75 ft. Span, Double Trolley, Electric Travelers, Commonwealth Steel Co., Granite City, Ill.

WHITING CRANES

ARE EQUAL TO EVERY TEST

The 35-Ton Electric Traveling Cranes here shown are meeting the most severe demands that can be made of any Crane, viz.: that of continuous

OPEN HEARTH STEEL FOUNDRY WORK.

BUILT FOR SERVICE

WHITING cranes are built for service. We put into them the accumulated experience of many years, the best material, modern engineering and good workmanship.

Don't Experiment with the Most Important Piece of Machinery in your Shop---Specify a WHITING.

Have you our Crane Catalog? Ask for No. 45.

Engineers Designers Manufacturers

WHITING FOUNDRY EQUIPMENT CO.

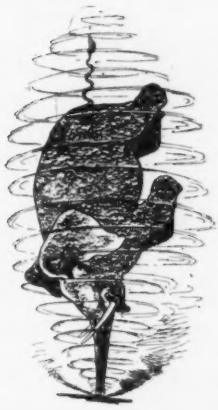
General Office and Works, HARVEY, ILL. (Chicago Suburb.)

NEW YORK, 29 BROADWAY
BOSTON, 141 MILK ST.
PITTSBURG, FARMERS BANK BLDG.
BUFFALO, ERIE CO. BANK BLDG.

Alphabetical Index to Advertisers.

Adams Co. 16, 159
Addy, Matthew, & Co. 172
Ajax Metal Co. 168
Albany and North River Molding Sand Co. 157
American Air Compressor Works. 170
American Blower Co. 26
Arcade Mfg. Co. 19
Atlas Car & Mfg. Co. 150
Baird & West 173
Ballou's White Sand Co. 166
Barnett, Oscar, Foundry Co. 33
Bartlett, N. S., & Co. 172
Basic Chemical Co. 167
Berkshire Mfg. Co. 17
Blackwell, Geo. G., Sons & Co. 169
*Blake, Geo. F., Mfg. Co. ..... —
Bonvillain, Ph., & E. Ronceray 20, 21
Brass Founders' Supply Co. 151
Bridgeport Safety Emery Wheel Co. 166
Bristol Co. 164
Brown Specialty Machinery Co. 22
Buffalo Furnace Works. 141
Burdick & Son. 161
*Byram & Co. ..... —
Carborundum Co. 142
Case Mfg. Co 146
Chicago Pneumatic Tool Co 38
Clark Cast Steel Cement Co. 30
*Cleveland Fillet Co 156
Columbus Iron & Steel Co. 172
Connersville Blower Co. ..... Back cover
Copper & Brass Publishing Co. 166
Cornell, J. B. & J. M., Co. 164
Curtis & Co. Mfg. Co. 28
*Deane Steam Pump Co 155
DeCamp Bros. & Yule Iron, Coal & Coke Co. 172
Detroit Foundry Supply Co. 131
Detroit Testing Laboratory 171
Diamond Clamp & Flask Co. 159
Dimmick, J. K., & Co. 172
Dings Electro Magnetic Separator Co. 163
Dobson, William. 165
Dodge & Day 171
Doggett, Stanley 160
Domhoff & Joyce Co. 172
Drucklieb, C. 142
Electric Controller & Supply Co. 145
Elliot, Debevoise & Anderson 173
Elm City Engineering Co. 163
Etting, Edward J. 151
Falls Rivet & Machine Co. 41
Federal Steel Fixture Co. 161
Field, Robt, Sales Agency. 173
Foundry Specialty Co. 161
Fox Machine Co. 156
Gautier, J. H., & Co. 48, 171
General Chemical Company 170
General Pneumatic Tool Co. 144
Gilmour, J. 150
Goldschmidt Thermit Co. 153
Goodrich, F. A., & Co. 172
Gunn, Richards & Co 133
Hanna Engineering Works. 35
Harbison-Walker Refractories Co. 165
Harrington, Edwin, Son & Co. 149
Haasenstein & Vogler ..... —
Herman Pneumatic Machine Co. 24
Hill & Griffith Co. 5
Hillman, J. H., & Son. 172
Hooper, G. K. 171
Independent Pneumatic Tool Co. 151
Jones & Attwood. 167
Keep, W. J 170
Kendall & Flick 170
Laclede Fire Brick Mfg. Co. 165
Lane, H. M. 171
Library Bureau. 135
Lindsay, W. W., & Co. 42
*Loughry, James C. ..... —
MacKellar's Sons Co. 167
Macphail Flask & Machine Co. 39
Manning, Maxwell & Moore. 147
Maris Bros. 145
Maurer, Henry & Son. 170
Maywood Foundry & Machine Co. 18
McCormick, J. S., Co. 8
McCullough-Dalzell Crucible Co. 50
McKeefrey & Co. 172
Metallurgical Laboratory. 171
Mfg. Equipment and Engineering Co. 146
Middleditch, Benj. 162
Midvale Mining & Mfg. Co. 168
Millett Core Oven Co. 37
Mills, C. E., Oil Co. 52
Mitchell-Parks Mfg. Co. 23
Mohr, J. J. & Son. 172
Monarch Engineering & Mfg. Co. 45
Mumford, E. H. Co. 12, 13
Nash, Isham & Co. 172
National Jeloluse Co. 167
New Era Mfg. Co. 169
Newport Sand Bank Co. 156
Niles-Bement-Pond Co. 148
Northern Engineering Works 146, 149
Norton Company 143
Norwalk Iron Works Co. 163
Obermayer, S., Co ..... Inside front cover, 1
Osborn Mfg. Co. 143
Otis Steel Co. 165
Pangborn, T. W. Co. 9
Partamol Co. 137
Pawling & Harnischfeger. 147
Paxson, J. W., Co. 2, 3, 4
*Pettinos Bros. 36
Phosphor Bronze Smelting Co. 168
Pickands, Brown & Co. 173
Pickands, Mather & Co. 173
Pilling & Crane. 173
Piqua Blower Co. 152
Pridmore, Henry E. 10 11
Punxsutawney Chamber of Commerce. 164
Randall, R. T., & Co. 144
Ransom Mfg. Co. 141
Rathbone, John A. 12
Ridgway, Craig, & Son Co. 40
Robeson Process Co. 53
Rockwell Engineering Co. 153
Roessler & Hasslacher Chemical Co. 152, 169
Rogers, Brown & Co. 173, 174
Roots, P. H. & F. M., Co. ..... Insert
Ross-Tacony Crucible Co 51
Seidel, R. B. Inc. 154
Sellers, Wm., & Co. 47
Shanafelt Mfg Co. 29
Shelton Metallic Filler Co. 32
Shepard, Chas. G. 173
Shuster, F. B., Co. 162
Sly, W. W., Mfg. Co. 34
Smith, J. D., Foundry Supply Co. 6, 7
Smooth-On Mfg. Co 31
Smyth, Swoboda & Co. 160
Standard Sand & Machine Co. 155
Sterling Oil Co. 167
Stevens, F. B. 43, 129, 173
Stephens & Co 162
Stockham Homogeneous Mixer Mfg. Co. 154
Stow Mfg. Co 141
Sturtevant, B. F., Co 27
St. Louis & San Francisco R. R. Co. 156
Tabor Mfg. Co. 14, 15
Taylor, A. L. 171
Taylor, Robert J., Inc. 49
Thomas Furnace Co. 173
Tilghman-Brooksbank Sand Blast Co. 44
U. S. Chaplet Supply Co. 154
United Iron & Steel Co. 46
United States Graphite Co. 152
Walter-Wallingford & Co. 173
Watt Cupola Twyer Co. 175
Western Foundry Supply Co. 169
Whiting Foundry Equipment Co. 54, 127
Wiener Co., Ernst. 149
Wilbraham-Green Blower Co. 25
Wonham & Magor. 148
Yale & Towne Mfg. Company. 142
Young, Frank L., & Kimball. 157

You Have Seen Nothing Like it.



There are all kinds of wet blackings but there is nothing on the market like **Stevens' Carbon Blacking.** The reason is simple.

The same basic materials are not used in any other blackings.

For that reason this blacking gives better actual service on loam or dry sand molds; and also when used as a core wash.

It is a labor saver, hence a money saver; and the better effect thrown in.

If eight or ten representative foundrymen called at your office to-day and told you that, from their own experience, my statement was the truth and nothing else, you would order a barrel.

Would you not?

I can send you a number of letters from foundrymen whom you know, giving just that verdict. Would not such evidence be convincing?

For use on cores, and that is a small item, comparatively, no foundry can afford to run without it.

GENUINE EAST INDIA PLUMBAGO

Absolutely pure---Goods of quality only.

STEVENS' CUPOLA DAUB

If your cupola lining is losing its youthful resistance you can renew its life---Another chance for economy.

I manufacture **Foundry Facings and Supplies and Polishers' and Platers' Supplies.** Quality goods only.

Frederic B. Stevens

Cor. Larned and Third Sts.
DETROIT, MICH.

See page 43

CLASSIFIED

BUYERS' DIRECTORY

Advertisers' names are inserted under this heading at the rate of four classifications to each page advertisement carried regularly.

Abrasive Materials:
Carborundum Company, Niagara Falls.
Norton Company, Worcester, Mass.

Accountants:
Library Bureau, Systematizing Dept., Boston.

Air Compressors:
American Air Compressor Works, New York.
Chicago Pneumatic Tool Co., Chicago.
Curtis & Co. Mfg. Co., St. Louis.
Independent Pneumatic Tool Co., Chicago.
Norwalk Iron Works Co., So. Norwalk, Conn.

Alloys:
Blackwell, Geo., Sons & Co., Ltd. Liverpool, Eng.
New Era Mfg. Co., Kalamazoo, Mich.
Phosphor Bronze Smelting Co., Ltd. Philadelphia.

Analysis—Mechanical:
Keep, W. J., Detroit.

Analysis—Chemical:
Detroit Testing Laboratory, Detroit
Metallurgical Laboratory, Pittsburg.

Anchors:
Lindsay, W. W. & Co., Philadelphia.

Babbitt Metal:
Ajax Metal Co., Birmingham, Ala.
New Era Mfg. Co., Kalamazoo, Mich.

Black Lead:
United States Graphite Co., Philadelphia.

Blowers:
American Blower Co., Detroit.
Connersville Blower Co., Connersville, Ind.
Cornell, J. B. & J. M. Co., New York.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson, J. W. Co., Philadelphia.
Piqua Blower Co., Piqua, O.
Roots, P. H. & F. M. Company, Connersville, Ind.
Sturtevant, B. F. Co., Hyde Park, Mass.

Blowers—Positive Pressure:
Connersville Blower Co., Connersville, Ind.
Piqua Blower Co., Piqua, O.
Roots, P. H. & F. M. Company, Connersville, Ind.
Sturtevant, B. F. Co., Hyde Park, Mass.
Wilbraham-Green Blower Co., Philadelphia.

Brakes (Electric):
Electric Controller & Supply Co., Cleveland.

Brushes:
Osborn Mfg. Co., Cleveland.

Buildings (Struct. Steel):
Lindsay, W. W. & Co., Philadelphia.

Burners (Oil):
Monarch Engineering & Mfg. Co., Baltimore.

Cams:
Haassenstein & Vogler, Frankfort, Germany.

Carbonese:
Midvale Mining & Mfg. Co., E. St. Louis, Ill.

Castings (Steel):
Otis Steel Co., Ltd., Cleveland.

Cement (Furnace):
Gautier, J. H. & Co., Jersey City.

Cement (Metallic):
Clark Cast Steel Cement Co., Shelton, Conn.
Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Chaplets:
Burdick & Son, Albany, N. Y.
Lindsay, W. W. & Co., Philadelphia.
Shanafelt Mfg. Co., Canton, O.

Coke:
Dimmick, J. K. & Co., Philadelphia.
Elliott, Debevoise & Anderson, New York.
Rogers, Brown & Co., Cincinnati.

Controllers (Electric):
Electric Controller & Supply Co., Cleveland.

Cores:
Brown Specialty Machry. Co., Chicago.

Core Binders:
Mills, C. E., Oil Co., Syracuse.
National Jeloluse Co., New York.
Robeson Process Co., Camden, N. J.
Sterling Oil Co., Emlenton, Pa.
Young, Frank L., & Kimball, Boston.

Core Compounds:
Young, Frank L., & Kimball, Boston.

Core Machines:
Brown Specialty Machry. Co., Chicago.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Jones & Atwood, Stourbridge, Eng.

Continued on page 132

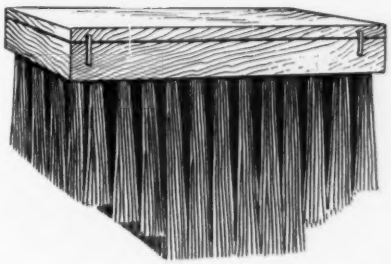
A Safe Proposition

Your money back if our No. 17 Core Wash will not satisfactorily peel your castings.

Here is our proposition:

Price $30.00 per ton — guaranteed to do your work to your satisfaction, can be returned at our expense, charging freight and cartage both ways, and that which you have taken out of shipment can be had with our compliments.

UP-TO-DATE



This brush has advantages which will doubtless appeal to you, if you are a practical man. Made of fine, tempered wire, and by its construction precluding the possibility of the wires breaking off at the ends of the brush. In other words, will outwear three or four of the ordinary wire brushes and will work more effectively. Do you not think the construction is **Common Sense**—that's what we call it.

Price $5.00 per dozen.

The Detroit Foundry Supply Co.

Facing Mills:
Detroit, Mich.

Facing
Fire Brick
Foundry Supplies
Foundry Equipment

Warehouses:
Detroit, Mich.
Windsor, Ont.

Core Ovens:

Atlas Car & Mfg. Co., Cleveland.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Millett Core Oven Co., Brightwood, Mass.
Pangborn, Thos. W. Co., New York.
Paxson, J. W. Co., Philadelphia.
Smith, J. D., Foundry Supply Co., Cleveland.

Core Oven Recording Thermometer:

Bristol Co., Waterbury.

Core Tapering Machines:

Brown Specialty-Machinery Co., Chicago.

Cost Keeping Systems.

Library Bureau, Systematizing Dept., Boston.
Loughry, James C., Elyria, O.

Cranes:

Case Mfg. Co., Columbus, O.
Curtis & Co. Mfg. Co., St. Louis, Ill.
General Pneumatic Tool Co., Montour Falls, N. Y.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia.
Niles-Bement-Pond Co., New York.
Northern Engrng. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Ridgway, Craig, & Son, Coatesville, Pa.
Sellers, William & Co., Inc., Philadelphia.
Whiting Foundry & Equipment Co., Harvey, Ill.

Crucibles:

Gautier, J. H. & Co., Jersey City.
McCullough-Dalzell Crucible Co., Pittsburg.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson, J. W. Co., Philadelphia.
Ross-Tacony Crucible Co., Philadelphia.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, A. L., San Francisco.
Taylor, Robt. J., Inc., Philadelphia.

Cupolas:

Byram & Co., Detroit.
Detroit Foundry Supply Co., Detroit.
Etting, Edward J., Philadelphia.
Gilmour, J., New York.
McCormick, J. S. Co., Pittsburg.
Northern Engrng Works, Detroit.
Paxson, J. W. Co., Philadelphia.
Whiting Foundry Equipment Co., Wonham & Magor, New York. Harvey, Ill.

Cupola Linings:

Laclede Fire Brick Mfg. Co., St. Louis.
McCormick, J. S. Co., Pittsburg.
Paxson, J. W. Co., Philadelphia

Drawings for Malleable Melting Furnace:

Buffalo Furnace Works, Buffalo.

Drills:

Chicago Pneumatic Tool Co., Chicago.
Independent Pneumatic Tool Co., Chicago.

Electric Generating Sets.

Sturtevant B. F. Co., Hyde Park, Mass.

Elevators:

Chicago Pnuematic Tool Co., Chicago.
Curtis & Co., Mfg. Co., St. Louis.
Ridgway, Craig, & Son, Coatesville, Pa.

Engines (Steam):

American Blower Co., Detroit.
Sturtevant, B. F. Co., Hyde Park, Mass.

Engineers (Foundry, Mech., Elec., &c.):

Dodge & Day, Philadelphia.
Hooper, Geo. K., New York City.
Lindsay, W. W. & Co., Philadelphia.

Exhausters (Gas):

Wilbraham-Green Blower Co., Philadelphia.

Facings:

Detroit Foundry Supply Co., Detroit.
Doggett, Stanley, New York.
Hill & Griffith Co., Cincinnati.
MacKeller's, R. Sons Co., Peekskill, N. Y.
McCormick, J. S. Co., Pittsburg.
Obermayer, S. Co., Cincinnati.
Paxson, J. W. Co., Philadelphia.
Pettinos Bros., Bethlehem, Pa.
Smith, J. D., Foundry Supply Co., Cleveland.
Stephens & Co., Kidwelly, Eng.
Stevens, F. B., Detroit.
Western Foundry Supply Co., E. St. Louis, Ill.

Fans:

American Blower Co., Detroit.
Sturtevant, B. F. Co., Hyde Park, Mass.

Ferro-Manganese:

Kendall & Flick, Washington, D. C.
Rogers, Brown & Co., Cincinnati.

Ferro-Silicon:

Roessler & Hasslacher Chemical Co., New York.
Rogers, Brown & Co., Cincinnati.

Fillers (Metallic):

Clark Cast Steel Cement Co., Shelton, Conn.
Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Fillets:

Cleveland Fillet Co., Cleveland, O.
Shanafelt Mfg. Co., Canton, O.

Fire Brick:

Detroit Foundry Supply Co., Detroit.
Gautier, J. H. & Co., Jersey City.
Harbison & Walker, Pittsburg.
Maurer, Henry, & Son, New York.
Laclede Fire Brick Mfg. Co., St. Louis.
Paxson, J. W. Co, Philadelphia.

Fire Sand:

Carborundum Co., Niagara Falls, N. Y.

Flasks:

Adams Co., Dubuque, Ia
Barnett, Oscar, Fdy. Co., Newark.
Brass Founders' Supply Co., Newark.
Macphail Flask & Machine Co., Chicago.
Middleditch, Benj., Detroit.

Continued on page 134

The Cost of It

The expense of a modern system of cost-keeping need be no greater than a crude, antiquated and inefficient way of keeping accounts.

Such a system is accurate, quick and in ample detail, and it gives the detailed costs of every part of the work while the business is fresh—when it is most valuable as a basis of comparison.

We have studied cost-keeping very carefully and have installed systems which meet these requirements in many well-known foundries.

Will you accord us an interview?

GUNN, RICHARDS & COMPANY

Production Engineers and
Public Accountants.....

43 WALL STREET,
43 EXCHANGE PLACE, } NEW YORK

50 CONGRESS STREET, BOSTON

224 ST. JAMES STREET, MONTREAL

Flasks (Snap):
Adams Co., Dubuque, Ia.
Diamond Clamp & Flask Co., Richmond, Ind.
Obermayer, S. Co., Cincinnati.
Paxson, J. W. Co., Philadelphia.

Flux:
Basic Chemical Co., Evansville, Ind.

Foundry Engineering:
Lane, H. M., Cleveland.

Foundry Equipment (Iron & Brass):
Barnett, Oscar, Foundry Co., Newark.
Etting, Edward J., Philadelphia.
Obermayer, S. Co., Cincinnati.
Pangborn, Thos. W. Co., New York.
Sly, W. W., Mfg. Co., Cleveland.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.
Wiener, Ernest, Co., New York.
Wonham & Magor, New York.

Foundry Supplies:
Detroit Foundry Supply Co., Detroit.
Hill & Griffith Co., Cincinnati.
McCormick, J. S. Co., Pittsburg.
Obermayer, S. Co., Cincinnati.
Osborn Mfg. Co., Cleveland.
Pangborn, Thos. W. Co., New York.
Paxson, J. W. Co., Philadelphia.
Shanafelt Mfg. Co, Canton, O.
Smith, J. D., Foundry Supply Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, A. L., San Francisco.
Taylor, Robert J., Inc., Philadelphia.

Furnaces (Melting):
Barnett, Oscar, Foundry Co., Newark, N. J.
Buffalo Furnace Works, Buffalo.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson, J. W. Co., Philadelphia.
Rockwell Engineering Co., New York.

Graphite:
United States Graphite Co., Philadelphia.

Grinding Machinery:
Adams Co., Dubuque, Ia.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Norton Co., Worcester.
Ransom Mfg. Co., Oshkosh, Wis.

Grinding Wheels:
Norton, Co., Worcester, Mass.

Hammers:
Independent Pneumatic Tool Co., Chicago.

Hammers (Pneumatic):
Chicago Pneumatic Tool Co., Chicago.

Heating & Ventilating Apparatus:
American Blower Co., Detroit.
Sturtevant, B. F. Co., Hyde Park, Mass.

Hoists:
Curtis & Co. Mfg. Co., St. Louis.
General Pneumatic Tool Co., Montour Falls, N. Y.
Harrington, Edwin, Son & Co., Philadelphia.
Niles-Bement-Pond Co., New York.
Northern Engrng. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Sellers, William, & Co., Inc., Philadelphia.
Sturtevant, B. F. Co., Hyde Park, Mass.
Whiting Fdy. Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York.

Hoists (Electric):
Yale & Towne Mfg. Co., New York.

Hoists (Hand):
Yale & Towne Mfg. Co., New York.
Northern Engrng. Works, Detroit.

Hoists (Pneumatic):
Chicago Pneumatic Tool Co., Chicago.
Ridgway, Craig, & Son, Coatesville, Pa.

Hydrofluoric Acid:
General Chemical Co., Philadelphia.

Industrial Ry. Equipment:
Atlas Car & Mfg. Co., Cleveland.
Wiener, Ernst, Co., New York.
Wonham & Magor, New York.

Iron Ore:
Rogers, Brown & Co., Cincinnati.

Ladles:
Northern Engrng. Works, Detroit.
Smith, J. D., Foundry Supply Co., Cleveland.

Magnets (Lifting):
Electric Controller & Supply Co., Cleveland.

Malleable Iron Melting Furnace:
Buffalo Furnace Works, Buffalo.

Molding Machines:
Adams Co., Dubuque, Ia.
Arcade Manufacturing Co., Freeport, Ill.
Berkshire Mfg. Co., Cleveland.
Bonvillain, Ph., & E. Ronceray, Paris, France.
Herman Pneumatic Machine Co., Zelienople, Pa.
Manning, Maxwell & Moore, New York.
Maywood Foundry & Machine Co., New York.
Mitchell-Parks Mfg. Co., St. Louis.
Mumford, E. H. Co., Philadelphia.
Paxson, J. W. Co., Philadelphia.
Pridmore, Henry E., Chicago.
Rathbone, John A., Detroit.
Smith, J. D., Foundry Supply Co., Cleveland.
Tabor Mfg. Co., Philadelphia.

Packing (Rubber Sheet):
Smooth-On Mfg. Co., Jersey City.

Parting Compounds:
Doggett, Stanley, New York.
Foundry Specialty Co., Cincinnati.
Partamol Co., New York.
Smyth, Swoboda & Co., New York City.

Pattern Letters:
Shanafelt Mfg. Co., Canton, O.

Patterns (Metal & Wood):
Herman Pneumatic Machine Co., Zelienople, Pa.

Pattern Shop Equipment:
Fox Machine Co., Grand Rapids, Mich.

Phosphorizers:
McCullough-Dalzell Crucible Co., Pittsburg.
New Era Mfg. Co., Kalamazoo.

Pig Iron:
Addy, Mathew, & Co., Cincinnati.
Baird & West, Detroit.

Continued on page 136

A watch-dog over costs

The natural tendency in any foundry is toward constantly increased costs. Here an unsuspected element of waste creeps in, there an item of expense grows imperceptibly, elsewhere a faulty method is eating up profits.

They appear plainly enough at the end of the year's business but their mischief has been done.

The cost system we install enables you to compare cost of production month by month in detail—to see every fluctuation in time to cut out quickly the cost increasers.

It is a watch-dog that guards the profits of your business.

We know you would be interested in the preliminary facts we can lay before you.

Will you give us an interview?

Systematizing department

Library Bureau

316 Broadway, New York

Bartlett, N. S. & Co., Boston.
Columbus Iron & Steel Co., Columbus.
De Camp Bros. & Yule, St. Louis.
Domhoff & Joyce Co., Cincinnati.
Elliott, Debevoise & Anderson, New York.
Field, Robert, Sales Agency, Cincinnati.
Goodrich, F. A. & Co., Detroit.
Hillman, J. H. & Son, Pittsburg.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., Philadelphia.
Nash, Isham & Co., New York.
Pickands, Brown & Co., Chicago.
Pickands, Mather & Co., Cleveland.
Pilling & Crane, Philadelphia.
Rogers, Brown & Co., Cincinnati.
Shepard, Chas. G., Buffalo.
Stevens, F. B., Detroit.
Thomas Furnace Co., Milwaukee.
United Iron & Steel Co., Pittsburg.
Walter-Wallingford & Co., Cincinnati & Pittsburg.

Plumbago:

Gautier, J. H. & Co., Jersey City, N. J.
Hill & Griffith Co., Cincinnati.
McCullough-Dalzell Crucible Co., Pittsburg.
Obermayer, S. Co., Cincinnati.
Pettinos Bros., Bethlehem, Pa.
Ross-Tacony Crucible Co., Philadelphia.
Smith, J. D., Foundry Supply Co., Cleveland.
Stevens, F. B. Detroit.
United States Graphite Co., Philadelphia.

Polishers' & Platers' Supplies:

Stevens, F. B., Detroit.

Riddles:

Adams Co., Dubuque, Ia.

Sand:

Albany and No. River Molding Sand Co., Albany, N. Y.
Ballou's White Sand Co., Millington, Ill.
Newport Sand Bank Co., Newport, Ky.
Pangborn, Thos. W. Co., New York.
Paxson, J. W. Co., Philadelphia.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.

Sand Blast Machinery:

Drucklieb, C., New York.
Pangborn, Thos. W. Co., New York.
Paxson, J. W., Co., Philadelphia.
Tilghman-Brooksbank Sand Blast Co., Philadelphia.

Sand Mixing Machinery:

Falls Rivet & Machine Co., Cuyahoga Falls, O.
Mumford, F. H., Philadelphia.
Pangborn, Thos. W. Co., New York.
Sellers, William & Co., Inc., Philadelphia.
Standard Sand & Machine Co., Cleveland.
Stockham Homogeneous Mixer Mfg. Co., Piqua, O.

Sand Sifters:

Chicago Pneumatic Tool Co., Chicago.
Deane Steam Pump Co., Holyoke, Mass.
Hanna Engrng. Works, Chicago.
Herman Pneumatic Machine Co., Zelienople, Pa.
Standard Sand & Machine Co., Cleveland.
U. S. Chaplet Supply Co., New York.

Saws (Cold Cutting):

Tabor Mfg. Co., Philadelphia.

Seacoal:

Hill & Griffith Co., Cincinnati.
Obermayer, S. Co., Cincinnati.
Paxson, J. W. Co., Philadelphia.

Separators (Magnetic):

Dings Electro Magnetic Sep. Co., Milwaukee.
Elm City Engineering Co., New Haven.
Pangborn, Thos. W. Co., New York.

Shafting (Flexible):

Stow Mfg. Co., Binghamton, N. Y.

Shifter Box:

Federal Steel Fixture Co., Chicago.

Shop Equipment:

Mfg. Equipment & Engineering Co., East Boston, Mass.

Shovels:

Stevens, F. B., Detroit.

Sprue Cutters:

Barnett, Oscar, Fdy. Co., Newark.
Shuster, F. B. Co., New Haven.
Middleditch, Benj., Detroit.

Stoppers:

McCullough-Dalzell Crucible Co., Pittsburg.
Ross-Tacony Crucible Co., Philadelphia.
Taylor, Robert J., Inc., Philadelphia.

Stove Trimmings:

Burdick & Son, Albany, N. Y.

Testing Machines:

Keep, W. J., Detroit.

Thermit Process:

Goldschmidt Thermit Co., New York.

Tools (Molders'):

Dobson, William, Canastota, N. Y.
Obermayer, S. Co., Cincinnati.
Paxson, J. W. Co., Philadelphia.
Smith, J. D., Foundry Supply Co., Cleveland.

Tools (Pneumatic):

Chicago Pneumatic Tool Co., Chicago.
Independent Pneumatic Tool Co., Chicago.

Tramrail Systems:

Randall, R. T. & Co., Philadelphia.

Trolleys:

General Pneumatic Tool Co., Montour Falls, N. Y.

Tumbling Mills:

Adams Co., Dubuque, Ia.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Gilmour, J., New York.
Sly, W. W., Mfg. Co., Cleveland.
Smith, J. D., Foundry Supply Co., Cleveland.

Twyers, Cupola:

Watt Cupola Twyer Co., Barnesville, Ohio.

Wire Straighteners:

Blake, Geo. F., Mfg. Co., New York City.
Shuster, F. B. Co., New Haven.

USE

PARTAMOL!

THE "NEVER STICK" PARTING

The Most Reliable and the Surest Compound for Parting Moulds in which Brass, Bronze, Ornamental Iron and Steel are Cast. Universally Adopted in Brass, Bronze, Iron and Steel Foundries.

A MOST PERFECT PARTING COMPOUND OTHERS USE IT. WHY NOT YOU?

1. **ACTS** as a perfect Separator.
2. **PREVENTS** the sand sticking to the pattern, and consequently produces a sharp, clean and perfect mold.
3. **PERMITS** the mold to absorb the water thoroughly—standing proper swabbing without the water running.
4. **ALLOWS** of easy and perfected 'slicking' of the mold.
5. **TURNS OUT A TRUE AND PERFECT MOLD** with every line, shape and conformation truly delineated as in the pattern.
6. **HENCE,** prevents imperfect corners and lines, defective designs, and 'sand stuck' castings.

* * *

Users of other compounds know that they stick to the molds, preventing the facings from operating properly "**PARTAMOL**" never sticks to the mold. When it parts it disappears.

As against the cost of the article, we figure the value of the proposition to you to work out as follows:

1. **EXCELLENT RESULTS** in your castings, from the largest ornamental structural shapes down to the smallest piece.
2. **THE DISCONTINUANCE** of patching and fixing up imperfect molds.
3. **ELIMINATION** of high priced, inflammable and wasteful materials from your foundry.
4. **GREATER EFFICIENCY** of, and personal satisfaction for, your molders.
5. **SAVING** in your time. Better net results.

* * *

Our steadily and increasing list of customers is convincing support for the claims made for **"PARTAMOL,"** and our assertion of a large **NET VALUE** to those using it.

A further use for "PARTAMOL" may be found on LARGE PATTERNS, such as flywheels, etc., and all heavy "green sand" work, where the application of this matarial over a coat of kerosene works a perfect result.

Among its many other uses it is ABSOLUTELY INVALUABLE for Moulding Machine work. The price will please you. Samples on Request. Ask your jobber or

THE PARTAMOL COMPANY

415 BROADWAY NEW YORK

CLASSIFIED ADVERTISEMENTS

Wanted and For Sale advertisements 40 cents a line. Positions and Help Wanted 25 cents a line. Count seven words to the line.

SUPERINTENDENT WANTED

A SUPERINTENDENT WANTED by one of the largest Steel Foundries in the country Only men of experience need apply. Give experiences and full particulars. Address Box 883, THE FOUNDRY, Cleveland, Ohio.

PRACTICAL FOUNDRY SUPERINTENDENT OR FOREMAN wanted to take interest and foremanship in a machine shop, pattern shop and foundry business already well established, located in one of the most promising cities and trade territories in the country. We have a good opening for the right man. Address Box 927, THE FOUNDRY, Cleveland, Ohio.

AN UP-TO-DATE SUPERINTENDENT wanted for large Steel Foundry in the West. One who is thoroughly familiar with general jobbing trade and railroad castings. Must be capable of handling between 400 and 500 men and a steady and sober man. A good opening with an old established firm for the right man. Write fully advising where last employed. Address Box 944, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WANTED

FOREMAN, familiar with heavy dry sand work, wanted by one of the largest steel foundries in the East. Applicants should give full particulars concerning their experience. Address Box 956, THE FOUNDRY, Cleveland, O.

A CAPABLE FOREMAN WANTED to take charge of entire plant outside of molding shop in an up-to-date Stove Foundry in Eastern Canada, running about forty molders. Address Box 948, THE FOUNDRY, Cleveland, O.

COMPETENT ASSISTANT TO GENERAL FOREMAN wanted in foundry employing 75 molders on high-grade work. Splendid opportunity for a young or middle-aged man. Address Box 898, THE FOUNDRY, Cleveland, O.

FOREMAN, up-to-date for jobbing foundry, employing about 20 molders, 17 miles from New York City. State wages, age and experience. Good opportunity for right man. Address Box 940, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WANTED. Up-to-date man with experience on medium floor and snap work, including use of molding machines—40 molders. Open shop. Address with references The Saml. C. Tatum Co., Cincinnati, O.

FOREMAN WANTED for a gray iron foundry employing about 120 men of all classes on work weighing up to two and one-half tons. Open shop and piece work. No labor trouble of any description. State age, experience and salary. Address Box 925, THE FOUNDRY, Cleveland, O.

FOREMAN FOR OPEN SHOP wanted, foundry employing about 15 molders near New York, making machinery castings up to three tons. Permanent position to capable and reliable man, and only such need apply, giving reference, age and salary wanted. Address Box 888, THE FOUNDRY, Cleveland, O.

WE WISH TO BUILD AND ESTABLISH up-to-date Foundry, both Iron and Brass castings to be used in our work. Shall take in such job work as comes to us. Located in very fine City. First-class foreman for each desired. State experience, salary and references. W. P. Hatch, 38 Murray Street, New York City.

FOREMAN capable of starting small Malleable Iron Foundry wanted. Write, giving references, experience and wages expected. Steady position for the proper applicant. Box 937, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN for gray iron and malleable plant. Must be experienced and a hustler and have ability to satisfactorily handle 225 men. Address Box 922, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WANTED as assistant in plant in Missouri, making railroad castings and general jobbing work, employing 12 to 15 molders. Splendid chance for advancement to foremanship as present foreman desires to retire. No labor trouble. Address, giving references, Box 932, THE FOUNDRY, Cleveland, O.

FOREMAN FOR FOUNDRY ON PUGET SOUND. Young man preferred, Must understand handling of men and ability to show results. Saw mill and general machinery. Twenty to thirty molders employed. No labor troubles. Good opening for proper man. Address Box 848, THE FOUNDRY, Cleveland, Ohio.

ASSISTANT FOREMAN to look after moulding machine section of Eastern Foundry. Energetic, practical, and experienced man, capable of handling 25 to 30 stripping plate and rock over machines. State class of work experienced on, and give full details. Confidential. Box 957, THE FOUNDRY, Cleveland, O.

CORE ROOM HELP WANTED

FOREMAN FOR CORE ROOM employing 12 men on agricultural implements. Must be strictly up-to-date in making different core mixtures and establishing piece-work prices. Non-union. State age, experience, references and wages expected. Address Box 859, THE FOUNDRY, Cleveland, Ohio.

FOREMAN FOR CORE DEPARTMENT wanted in a large foundry (steel) at Detroit, Mich. Must thoroughly understand all branches of core making, and be able to handle a crew of fifty men. State what experience you have had, where last employed. Address Box 943, THE FOUNDRY, Cleveland, O.

FOREMAN FOR CORE ROOM wanted. Class of work, Structural and Ornamental Iron and Bronze, also Machine Castings. Must be able to handle men and get work out cheap. No one but those having experience need apply. Steady position. Answer, stating salary wanted and references. Box 930, THE FOUNDRY, Cleveland, O.

MOLDERS WANTED

AT ONCE eight first-class, all-round green-sand, non-union molders, accustomed to medium floor work, pieces weighing 100 to 1,500 lbs. each. Only sober, industrious molders, with good recommendations need apply. We want steady men, and will guarantee a year's job to molders who make good. No trouble in the shop. Non-union shop for three years. Address Box 902, THE FOUNDRY, Cleveland, Ohio.

THREE OR FOUR GOOD MOLDERS WANTED for light work. Open shop, union scale wages. Only good, steady men need apply. New Specialty Mfg. Co., Council Bluffs, Iowa.

A FEW FIRST-CLASS MACHINERY MOLDERS wanted. High wages, permanent employment, no trouble. Address Box 929, THE FOUNDRY, Cleveland, O.

HELP WANTED, MISCELLANEOUS

RIGGER-UP FOR EASTERN FOUNDRY making medium-sized gray iron castings on stripping plate and rock-over machines. Practical man will be liberally treated when ability is proven. State experience, age, salary desired, and class of molding machine work experienced in. Will treat strictly confidential if desired. Box 934, THE FOUNDRY, Cleveland, O.

UP-TO-DATE MANAGER WANTED for a moderate sized foundry now under construction. One who has been a successful foundry foreman preferred. Address Box 890, THE FOUNDRY, Cleveland, O.

KNIFE MAKER: Concern manufacturing cutlery wants thoroughly experienced knife maker. Man must be thoroughly familiar with details of this business. No one using intoxicating liquors will be considered. Salary, $80-$100 per month.

SAW MAKER: Same company also wants experienced saw maker and will pay the same salary to man who meets requirements. Write us today stating age and experience fully. (TMis 603) Hapgoods, 305 Broadway, N. Y.

FOREMAN FOR CLEANING ROOM. Good pay to man who can handle thirty-five snaggers to best advantage. Must be thoroughly familiar with pneumatic chippers, sand blast, and other modern devices. State full particulars regarding age, references, experience, and pay desired. Strictly confidential if requested. New England, Box 933, THE FOUNDRY, Cleveland, O.

A THOROUGH BUSINESS AND SALES MANAGER wanted for foundry located in the Southern part of Ohio. One who can invest from $10,000.00 to $25,000.00 in the business. Commission paid, in addition to salary, on all profits. One preferred who has some knowledge of Foundry business and can take charge of the sales of the product. Address Box 958, THE FOUNDRY, Cleveland, O.

FIRST-CLASS MASTER MECHANIC WANTED for large malleable iron and steel foundry. Must understand electrical work and be able to handle men to good advantage. State age, experience and salary wanted. Communications strictly confidential. Apply Box 917, THE FOUNDRY, Cleveland, O.

SUPERINTENDENTS WANT POSITIONS

CORRESPONDENCE SOLICITED from Stove Manufacturers contemplating a change in management of their plant. Reference given as to ability, character, habits and experience. Address Box 919, THE FOUNDRY, Cleveland, O.

POSITION AS SUPERINTENDENT OR GENERAL FOREMAN wanted in a malleable iron foundry. Successful in handling men with good results. Up-to-date, good mixer and A. No. 1 reference. Address Box 893, THE FOUNDRY, Cleveland, O.

POSITION AS SUPERINTENDENT OR GENERAL FOREMAN wanted by a practical foundryman, 22 years experience, up-to-date on the latest methods. Understand molding machines thoroughly. Best of reference. Address Box 953, THE FOUNDRY, Cleveland, O.

POSITION AS SUPERINTENDENT or general foreman wanted by a practical foundryman. 33 years' experience in the foundry business. At present superintendent of a steel and iron foundry using converter. Malleable or steel foundry preferred. Address Box 912, THE FOUNDRY, Cleveland, Ohio.

SUPERINTENDENT.—Young man, hustling, aggressive and systematic; familiar with metal pattern plate work, molding machines, tools and fixtures for production of plumbers' brass and iron goods. Up-to-date methods of handling help and getting the work out. Address Box 950, THE FOUNDRY, Cleveland, O.

POSITION AS SUPERINTENDENT OR MANAGER in foundry, wanted, by a competent man, well up in small and medium-sized work, annealed and soft castings and general tool and engine work. Experienced in mixing metals for all grades of work. Thoroughly commercial and able to manage a plant profitably. Address Box 896, THE FOUNDRY, Cleveland, O.

PATTERNSHOP HELP

AN EXPERIENCED FOREMAN PATTERNMAKER desires situation. Address Box 946, THE FOUNDRY, Cleveland, O.

PATTERN SHOP FOREMAN open for position, 17 years as foreman on General Machinery. Address Box 928, THE FOUNDRY, Cleveland, O.

POSITION AS CHARGE HAND PATTERNMAKER wanted. Experience in nearly all kinds of work. State of Wisconsin or Michigan preferred. Address Box 918, THE FOUNDRY, Cleveland, O.

SALESMAN

EXPERIENCED SALESMAN will consider position as New York representative of first-class iron or brass foundry. Address "Experienced," THE FOUNDRY, 150 Nassau Street, New York.

POSITION AS SALESMAN FOR PIG IRON or foundry supplies wanted. Young man, foundry experience, well known by trade, good appearance, college (metallurgical) education. Middle West preferred. Address Box 942, THE FOUNDRY, Cleveland, Ohio.

COREROOM HELP

A COREMAKER of 23 years' experience on gasoline engine cylinders, steam cylinders and general jobbing work, wants to get in communication with all firms who are losing any intricate piece from defective cores. I have a proposition to make you. Box 935, THE FOUNDRY, Cleveland, O.

FOREMANSHIP WANTED

POSITION AS FOREMAN in foundry making light and medium gray iron castings by an experienced man, 37 years of age. 19 years in foundry business, 11 years as foreman. Up-to-date in modern cupola practice, coremaking and handling help. Expert at mixing iron. Can handle from 50 to 75 molders on floor and bench. Can furnish references. Employed at present but would like a change. Address Box 941, THE FOUNDRY, Cleveland, O.

FOREMAN BRASSMOLDER, at present handling 10 to 15 molders, on all around work, 3 years present position, desires change. Address Box 951, THE FOUNDRY, Cleveland, O.

POSITION AS ASSISTANT FOREMAN wanted by a middle-aged man, graduate International Correspondence Schools, Scranton, Pa., Foundry Course. Address Box 949, THE FOUNDRY, Cleveland, O.

POSITION AS FOREMAN WANTED by a first-class foundryman with good executive ability on light and heavy work. Can furnish best of references. Address Box 926, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN desires position. Fifteen years experience on ornamental iron and bronze castings, 8 years a foreman. Well up in cupola practice. Best of reference. Address Box 954, THE FOUNDRY, Cleveland, O.

POSITION AS FOREMAN in a light gray iron shop wanted. Twenty-two years' experience as molder. Understand molding machines and cupola practice. Can furnish reference. Address Box 931, THE FOUNDRY, Cleveland, O.

POSITION AS FOUNDRY FOREMAN wanted. Machinery or jobbing shop preferred. Up-to-date in all foundry practice. Middle West or eastern states preferred. References furnished. Address Box 960, THE FOUNDRY, Cleveland, O.

POSITION AS FOREMAN WANTED by a young, practical man. Five years' experience as foreman, thoroughly understands Molding Machines and up-to-date foundry practice. A.1 reference. Address Box 959, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WANTS POSITION. Young married man experienced in green and dry sand, molding machines and cupola practice. Have good executive ability and can furnish best of references. Address Box 945, THE FOUNDRY, Cleveland, O.

POSITION WANTED by an up-to-date foundry foreman. Twenty years in the business. Have been with some of the largest gray iron foundries in the United States. Also good experience in Malleable and Brass. Address Box 921, THE FOUNDRY, Cleveland, O.

POSITION AS GENERAL FOREMAN. 12 years' experience as Superintendent or Foreman on Steam and Water Heaters and Radiators. I am looking for a good proposition and will furnish A1 references. Address Box 924, THE FOUNDRY, Cleveland, O.

CONTINUED ON PAGE 140

POSITION AS FOREMAN WANTED in a small shop or assistant Foreman in large shop. Twenty-five years' experience on light and heavy machinery work, also Gas Engines and Heaters. Student in mechanical engineering in the I. C. School. Address Box 938, THE FOUNDRY, Cleveland, Ohio.

POSITION AS FOREMAN OR ASSISTANT wanted in Malleable Foundry by a practical Molder having had five years' experience as assistant foreman and instructor in large malleable foundry. Understand operating Air furnaces. Strictly temperate. Address Box 923, THE FOUNDRY, Cleveland, O.

POSITIONS WANTED, MISCELLANEOUS

SITUATION WANTED by young man (thirty). Experience of general character. For past 4 years with Foundry Corporation, having charge of office; purchasing and selling. Experience as Salesman and acquainted in Greater New York and Connecticut. Address Box 920, THE FOUNDRY, Cleveland, O.

ANNEALER DESIRES POSITION. Can construct and repair ovens, either for coal or oil. Thoroughly reliable and temperate in habits. Can furnish good references. Address Box 915, THE FOUNDRY, Cleveland, O.

POSITION AS MANAGER OR ASSISTANT in an iron foundry, preferably Cast Iron Soil Pipe line, wanted by a married man of twenty-seven. Eight years' experience. Best references. Address Box 914, THE FOUNDRY, Cleveland, O.

A PRACTICAL FOUNDRYMAN, up-to-date in mixing of iron, perfect in core work, also in green and dry sand and loam, best of character and sober, wants to change position. Open shop preferred. Address Box 939, THE FOUNDRY, Cleveland, O.

CRANEMAN.—A first-class competent Craneman who thoroughly understands the care and operation of electric traveling cranes, foundry work a specialty, desires to make a change. Temperate, industrious, with A.1 references. Address Box 952, THE FOUNDRY, Cleveland, O.

PROPERTY FOR SALE

FOUNDRY COMPLETE, two cranes, machinery patterns. Brick building, side track, etc. Box 347, Celina, Ohio.

THE LEADING JOBBING PATTERN SHOP of Colorado is for sale.
J. L. Gard, Denver, Colo.

FOUNDRY FOR LEASE in St. Louis, in running order, 5,000 ft. floor space, $25.00 per month, for sale, $2,000, one-fourth down. Plenty space for expansion. Address Foundry, 3rd and Pope Ave., St. Louis, Mo.

CUPOLAS, ETC., FOR SALE

TWO SECOND-HAND CUPOLAS IN FIRST-CLASS condition. Shells 72"-82" in diameter and about 40 feet high. Box 800, THE FOUNDRY, Cleveland, Ohio.

ONE SECOND-HAND CUPOLA in first-class condition for sale, capacity 4 to 5 tons per hour, diameter of shell 48", diameter inside of lining 34", total height 72', complete with lining. Can be seen at our shops in position. Address Ames Iron Works, Oswego, N. Y.

FOR SALE, MISCELLANEOUS

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or Agents Penna. Salt Mfg. Co., Pittsburg, Pa.

FOR SALE.—One 30 x 30" Pridmore Molding Machine. Address The Crossley Mfg. Co., Trenton, N. J.

ONE CLEVELAND SAND MIXER in A-1 condition for sale. The Gardner Governor Co., Quincy, Ill.

PHOSPHORUS STICKS OR CAKES for phosphorizing bronze, tin and other metals. J. W. Paxson Co., Philadelphia, Pa.

NEW ADAMS MOLDING MACHINE 60-in. size, cost $95.00. Will sell for $65.00 cash Chicago. William R. Perrin & Co., Loomis and 46th streets, Chicago, Ill.

FLUOR SPAR.—We mine and sell gravel, lump and ground fluor spar in barrel, ton and carload lots. Prices and samples on application. Geo. P. Roberts & Co., Marion, Ky.

BLOWER BARGAINS.
Roots Second-Hand Blowers, bought, sold or exchanged for new ones. Address,
H. M. PAPWORTH,
120-122 Liberty Street, New York City.

PATTERNS, PATENTS AND SPECIAL MACHINE for machining sections of Hot Water and Steam cast iron boiler, for sale. The boiler is well known in the trade, has an excellent reputation. A chance for some concern which desires to add a Steam and Hot Water boiler to their line. Address Box 955, THE FOUNDRY, Cleveland, O.

One 6-ton Jib Crane with mast 20 feet high, Jib 18 feet long.
One 1200-lb. Ball drop weight.
One 1800-lb. Ball drop weight.
William R. Perrin & Co., Loomis & 46th streets, Chicago, Ill.

PULLEY MACHINES FOR SALE
2 No. 1
2 No. 2
1 No. 3
1 No. 4
with single and double belt patterns ranging from 6" to 48" and arms and hubs to suit.
All machines and patterns in first-class condition, also 40,000-lb. Iron Flasks for various size pulleys. Davison Foundry Co., E. Chicago, Ind.

SECOND-HAND MATERIAL AS FOLLOWS:
2 No. 7 Baker Blowers with Engines.
1 No. 7 Green Blower and Engine.
1 each—No. 3, 4 and 5 Baker Blowers, belt-driven.
1 each—No. 6 and 7 Sturtevant Blower, motor-driven.
1 No. 5 Sturtevant Blower, belt-driven.
1 each—1½, 2, 7, 12 and 25-ton Geared Ladles.
2 Paxson Colliau Cupolas, 72".
1 No. 80 Eureka Core Oven.
2 Millet Core Oven, stationary.
1 Erie Air Compressor, 6" x 6", belt-driven, automatic cut-off, $125.
1 Sellers Centrifugal Sand Mixer.
J. W. Paxson Co., Philadelphia, Pa.

PROPERTY WANTED

A SMALL MACHINE SHOP AND FOUNDRY wanted. One operating fifteen to twenty men. Southern state location preferred. Address Box 916, THE FOUNDRY, Cleveland, O.

FOUNDRY WANTED. A manufacturing city needs a foundry. Have large local demand, four railroads and excellent factory sites. An ideal location. Commercial Club will give substantial encouragement to parties with experience and capital.
Address J. C. Lochner, Secy., Auburn, Ind.

WANTED MISCELLANEOUS

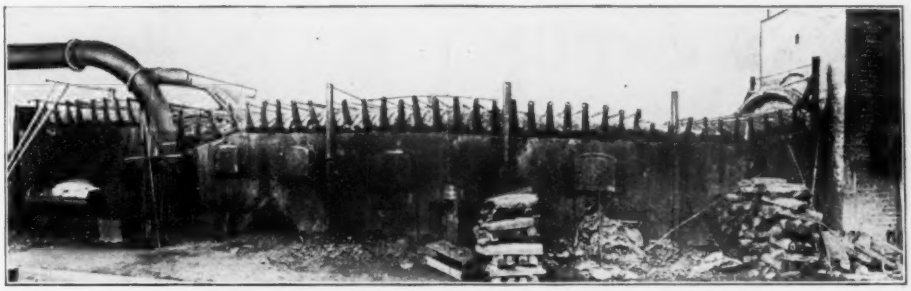
OIL FURNACE WANTED. A No. 3 or No. 4 Rockwell Engineering Co.'s in first-class condition. State price and time in use. Address Box 947, THE FOUNDRY, Cleveland, O.

SECOND-HAND FOUNDRY EQUIPMENT WANTED, including Cupolas, Ladles, Tumbling Barrels, etc. Quote price and state condition. Address Box 885, THE FOUNDRY, Cleveland, O.

A NEW YORK CONCERN DESIRES THE SALES AGENCY of Machinery or Specialties for foundry, mill or contractors' use. Success in selling insured by up-to-date methods. Address Box 877 THE FOUNDRY, Cleveland, O.

A FULL SET OF CAST IRON FITTING PATTERNS, all sizes from ¼" to 12" inclusive, wanted by a Canadian manufacturer. Square bead pattern preferred. State price, where patterns can be seen, and how long they have been in use. Reply to Box 936, THE FOUNDRY, Cleveland, O.

MODERN
MALLEABLE IRON MELTING FURNACE
OPERATED IN U. S. AND CANADA



See one in operation—it will pay you

Special Features: Strong construction---light bung clamps---swinging side doors---large hearth---proper air distribution---a rapid melter. Also annealing and re-heating furnaces, core ovens, etc.

Quotations of drawings or furnace complete upon application.

Buffalo Furnace Works 229 Carolina St., BUFFALO, N. Y.

ESTABLISHED 1875.

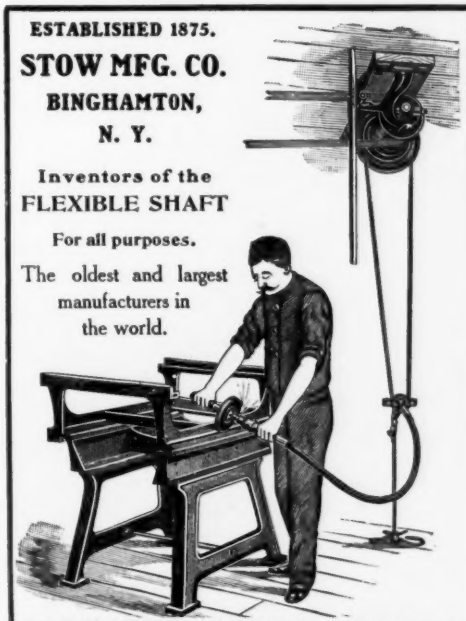
STOW MFG. CO.

BINGHAMTON, N. Y.

Inventors of the FLEXIBLE SHAFT

For all purposes.

The oldest and largest manufacturers in the world.



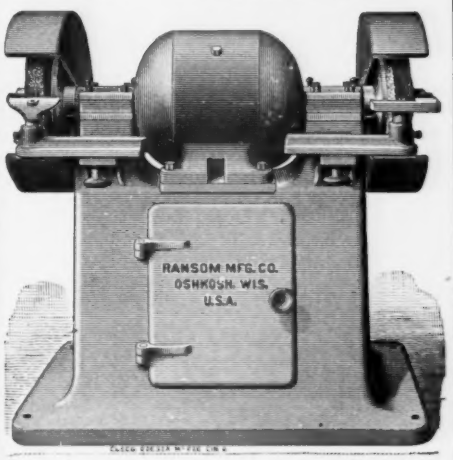
PORTABLE EMERY GRINDER

Take the tool to the work and save heavy handling.

Write us for Catalogue and Prices.

General European Agents: Messrs. Selig, Sonnenthal & Co., 85 Queen Victoria St., London, Eng.

MOTOR DRIVEN DRY GRINDERS



SURE TO GIVE SATISFACTION

RANSOM MFG. CO.

OSHKOSH - - - WIS.

CARBORUNDUM FIRE SAND

resists temperatures that turn clay into vapors. It is unquestionably the best lining or patching and repairing material ever discovered for furnaces where high temperatures and intense flame action are encountered. If you have high temperature furnaces you can't afford to be without

CARBORUNDUM FIRE SAND

THE CARBORUNDUM COMPANY
NIAGARA FALLS, N. Y.

J. W. Jackman & Co., Ltd.,
Caxton House, Westminster, London, S. W., Eng.
Agents for this material in Great Britain.

THE INJECTOR SANDBLAST APPARATUS

For cleaning thoroughly Steel, Iron and Brass Castings with minimum amount of compressed air and maximum speed.

C. DRUCKLIEB,
132 Reade St., New York.

The "Everlasting" Triplex Block

A 216 MILE Chain Block Lift

Twenty YALE & TOWNE TRIPLEX BLOCKS have been in use for about 6 years in a rubber works. Each block makes lifts averaging daily 600 ft. This is at the rate of 3 miles per month, 36 miles per year or 216 miles in 6 years.
The blocks are still in first-class shape.

Can you use hoists like these?

YALE & TOWNE MFG. CO.
9-15 Murray St., New York.